2006 Ontario Building Code Overview Training Courses

Plumbing – House – 2007

Participant's Manual

Building and Development Branch
Ministry of Municipal Affairs & Housing

Ontario

Ontario

2006 Ontario Building Code Overview Training Courses

PLUMBING - HOUSE - 2007

PARTICIPANT'S MANUAL

This course was developed by **Morrison Hershfield Limited**

for the **Ontario Ministry of Municipal Affairs and Housing.**

The course is based on the Ontario Building Code 2006 (O. Reg. 350/06), as amended.

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MODULE 1

INTRODUCTION

PLUMBING - HOUSE - 2007

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INTRODUCTION

Welcome! Over the next few days, you will be concentrating on the technical requirements of Division B, Part 7 of the Ontario Building Code (OBC or the Code), as well as inspection techniques and procedures.

The course is designed to demystify these matters and make you confident and comfortable with an inspection process developed to ensure the health and safety of your community.

There are many resources that will assist you in this course, including:

- Your experience as an inspector
- The experience of others in the class
- The OBC and Building Code Act
- Exercises that ask you to understand why the regulations exist and to relate your experience to the information presented
- This workbook. This is your book, and you are encouraged to record answers and write notes in it. It will be a useful reference when you are back on the job.

MEET YOUR GROUP

Before you start into the course materials, it is important for you to meet the people you will be working during this course. You have had a variety of experiences as an inspector, which you can share with the class; similarly, they have had experiences that they can share with you.

<u>EXERCISE 1-1</u>

Take a few minutes and introduce yourself to your group.
Let them know where you're from and what your background is. Listen carefully to the types of job experiences that other members of your group have had. You will find them useful in completing exercises later on in this course.

NAME	JOB TITLE	WORK RESPONSIBILITIES

STOP

THE CONTEXT OF THIS COURSE

The original Plumbing – House course was originally developed by the Municipal and Industry Training and Education Council (MITEC). The course has been updated to reflect the changes in the 2006 Ontario Building Code.

The Ontario Ministry of Municipal Affairs & Housing's role is the development and delivery of training programs to meet the training needs of municipal inspectors from the following associations:

- Ontario Building Officials Association
- Ontario Association of Property Standards Officers
- Ontario Plumbing Inspectors Association
- Municipal Law Enforcement Officers Association

Some of you may have taken one or more of the other courses offered. If you have, please share what you learned with the rest of your group as you go through this course. If you have not, don't worry; all the information you'll need to complete the exercises and pass the tests will be provided as you go along.

THE MUNICIPALITY/REGION

Plumbing inspection takes place in the context of the municipality or the region. The types of services offered by the municipality or region, such as water service and sewage disposal, have an impact on your role as a plumbing inspector.

The size of your municipality or region also affects your job. In smaller areas you may have to "wear many hats"—that is, you may be the building inspector as well as the plumbing inspector.

ROLES OF THE PLUMBING INSPECTOR

Regardless of the other hats you may wear, you have a very important job as a plumbing inspector. Your role is to ensure the health and safety of residents in your community by:

- Providing information—technical knowledge and information about the appropriate legislation—to contractors, the public and your Council
- Examining the plumbing systems under your jurisdiction to ensure they comply with regulations
- Applying, interpreting, administering and enforcing the requirements
- Employing all your technical and personal skills to gain voluntary compliance with the Code
- Cooperating with other building officials in the interests of the public

Being an inspector calls for a combination of technical knowledge and an ability to deal with the public. Technical problems can usually be dealt with fairly easily—but dealing with the public requires tact and good judgment.

FORMAL COURSE OBJECTIVES

This course has some specific objectives in mind. See how closely they match your own.

By the end of the course, you will:

- Relate the regulations relevant to plumbing inspection
- Explain the role of a plumbing inspector
- Explain the basic theory of plumbing systems
- Explain, in detail, the plumbing in a typical single-family dwelling
- Apply a set of materials and attitudes common to other plumbing inspectors to help you on the job
- Describe how to inspect plumbing installations
- Explain the authority, responsibility and accountability of a plumbing inspector
- Analyze plans of buildings and drawings of plumbing installations

OUTLINE OF THE COURSE

The course begins with an introduction to a model plumbing system. Once you understand how the plumbing system works, inspecting it will be easier. Then you will learn about your authority as a plumbing inspector and the legislation giving you that authority.

Next is an introduction to the inspection process, including a checklist that you will use for the rest of the course. The plumbing permit is the first step in the inspection process. After covering this, the first two major inspection phases will be covered in detail.

Once you have learned what to look for on these inspections, you will tackle the problem of noncompliance and how to deal with it. While the course focuses on the single-family dwelling, you will encounter other types of buildings on your inspections in the future. Consult with other officials when problems are encountered.

There will be quizzes at the end of each module to evaluate how much you have retained.

RESOURCE MATERIAL

You will require the following resource materials for this course:

- 2006 Ontario Building Code Volume 1 and 2
- Building Code Act

These documents are available from:
www.publications.serviceontario.ca

The 2005 National Plumbing Code is optional for this course but may be of use in your regular work. This document is available from www.nrc-cnrc.gc.ca/virtualstore

A calculator, a highlighter and some sticky notes are recommended tools for helping you mark key tables and requirements.

STOP

THE OBJECTIVE-BASED CODE

The 2006 Ontario Building Code is published in an "objective-based" format. The objective-based format adds to the technical requirements by identifying the underlying objectives and sub-objectives of those requirements. Each technical requirement that is an acceptable solution in Division B is linked to one or more objectives, as well as functional statements.

The objective-based format is intended to assist Code users in understanding technical requirements, why they exist and what they are intended to achieve. The objective-based code establishes a framework for evaluating "alternative solutions" against the performance achieved by "acceptable solutions" set out in the Code.

This course is updated to reflect technical changes to the 2006 Ontario Building Code. **Training related to the objective-based format, and how to deal with alternative solutions is part of another course.** This course addresses only "acceptable solutions".

A few key points about the objective-based code are below.

The organization of the 2006 Code is:

Division A Compliance, Objectives and Functional Statements

The new objectives and functional statements are in Division A. Definitions and the application of the Parts of the Code are here.

Division B Acceptable Solutions

This is where the technical requirements of the 1997 Code are located, with a similar Part structure.

Division C Administrative Provisions

This Division deals with permits, inspections and qualifications.

Remember that the full reference for Part 7 Plumbing is "Division B, Part 7 Plumbing". Always specify the appropriate Division if there is any chance of confusion. Where the Division is not referenced within this course, it is Division B.

When "OBC" is used in this course it refers to the Ontario Building Code, NOT the Objective Based Code.

STOP

A GUIDE TO THE USE OF THE OBC

The Ontario Building Code is a regulation made under the Building Code Act.

The Code is essentially a set of minimum requirements governing the safety of buildings. It is not intended to be a textbook on plumbing design, advice on which should be sought from professional sources. Its primary purpose is the promotion of public safety through the application of appropriate uniform building standards.

The decimal numbering system of the previous Code is maintained within Divisions A, B and C of the 2006 Code. The first number indicates the Part of the Code, the second, the Section in the Part, the third, the Subsection and the fourth, the

Article in the Subsection. An Article may be further broken down into Sentences (indicated by numbers in brackets), and the Sentence further divided into Clauses and Subclauses.

These are illustrated as follows:

7	Part
7.3.	Section
7.3.4.	Subsection
7.3.4.5.	Article
7.3.4.5.(5)	Sentence
7.3.4.5.(5)(a)	Clause
7.3.4.5.(5)(a)(i)	Subclause

Defined Words, Terms And Phrases

Words, terms and phrases with special meaning are defined in Division A, Article 1.4.1.2. of the OBC, and are shown within the body of the OBC in *italics*. The definition always applies unless the word, term or phrase has a special purpose definition listed elsewhere.

Non-Defined Words, Terms And Phrases

Consult Division A, Article 1.4.1.1. of the OBC. It provides direction for dealing with non-defined terms.
Note any questions, comment or concern in the space provided.

____

____

____

Abbreviations and Symbols and Referenced Documents

The OBC uses abbreviations and symbols throughout. Their meaning is found in Division A, Subsection 1.4.2.

For example, the abbreviation DWV means drain, waste and vent; and the expression '1 in 2' means a slope of 1 vertical

unit to 2 horizontal units.

Abbreviations for organizations and associations (proper nouns) are found in Table 1.3.2.1. in Division B. For example, ASHRAE means American Society of Heating, Refrigerating and Air-Conditioning Engineers.

The table of all documents referenced in the OBC is found in Part 1 of Division B.

BASIC RULES FOR READING THE OBC

Scope And Application Of OBC Requirements

Individual requirements within the OBC do not apply to every *building*. Guidance in the application of each of the 12 Parts of Division B is found in Division A, Subsection 1.1.2.

For this course, it is important to know that Part 7 of Division B applies to all buildings.

Dealing With 'And'

The word '**and**' found at the end of the second last Clause of a Sentence with multiple Clauses means that the requirements of <u>every</u> Clause apply to the Sentence.

For example, Sentence 7.5.6.3.(1) reads:

> Except as provided in Sentences (2) and (3), a vent pipe that protects a fixture trap shall be located so that,
>
> (a) the developed length of the trap arm is not less than twice the size of the fixture drain,
>
> (b) the total fall of the trap arm is not greater than its inside diameter, <u>and</u>
>
> (c) the trap arm does not have a cumulative change in direction of more than 135 degrees.

Dealing With 'Or'

The word '**or**' found at the end of the second last Clause of a Sentence with multiple Clauses means that the requirement of the Sentence is satisfied by <u>any</u> Clause as

applied individually.

For example, Sentence 7.5.3.1.(6) reads:

> Additional circuit vents shall be required,
>
> (a) when each cumulative horizontal change in direction of a branch served by a circuit vent exceeds 45 degrees between vent pipe connections, or
>
> (b) where more than 8 circuit vented fixtures are connected to a branch between vent pipe connections.

Rules Of The OBC

The OBC is structured into a number of Rules that apply without exception.

For example, Sentence 7.5.7.2.(2) states:

> Every sanitary building drain shall terminate at its upstream end in a stack of at least 3 in. size.

General Rules Of The OBC And Exceptions

At other times, the user of the OBC has to consider a general rule and exceptions that may be applicable. Consider the requirements for the size of fixture outlet pipes given in Article 7.4.9.3.:

> (1) Except as provided in Sentence (2) the size of every fixture outlet pipe shall conform to Table 7.4.9.3.
>
> (2) The part of the fixture outlet pipe that is common to 3 compartments of a sink shall be one size larger than the largest fixture outlet pipe of the compartments that it serves.

When the OBC spells out a general rule and exceptions thereto, conformity with the OBC is obtained by complying with EITHER the general rule OR the exception.

Tables, Text And Footnotes

Whenever you are called upon to use a Table in the OBC, you have to consider the text associated with the Table <u>and</u> the footnotes.

For example, Table 7.4.10.8. forms part of Sentence 7.4.10.8.(1). Note (1) to Table 7.4.10.8. tells us that slope is the ratio of rise to run, in whatever measurement units are chosen.

Supplementary Standards And Referenced Documents

The Supplementary Standards, published as Volume 2 of the 2006 Building Code Compendium form an **integral part of the 2006 Ontario Building Code.**

The Supplementary Standards are referenced from within the OBC. For example, Sentence 7.4.10.4.(1) states that the maximum 15 min rainfall is to be determined in conformance with Supplementary Standard SB-1.

Appendices

The **Appendices to the Ontario Building Code**, published in Volume 2, **have been prepared for convenience only**. This material contains explanations that do <u>not</u> form part of the OBC and are <u>not</u> intended to limit the ways by which compliance with OBC requirements can be achieved.

STOP

LIST OF ABBREVIATIONS

The following abbreviations are used in this course:

BCA	Building Code Act
CO	cleanout
DWV	drain waste vent
FD	floor drain
LAV	lavatory
OBC	Ontario Building Code
SS	soil stack
WC	water closet
WS	waste stack

THE MITEC HOUSE

EXERCISE 1-2

In the next several pages, you will find drawings and plans of the MITEC house (Figures 1:1 through 1:4). These drawings are also in the Appendix and should be used as reference throughout the course.

Working with your group, make a list of the plumbing fixtures and appliances that may be expected in the basic house as indicated in the following drawings; report it on your flipchart.

Notes:

Figure 1:1 MITEC BASEMENT PLAN

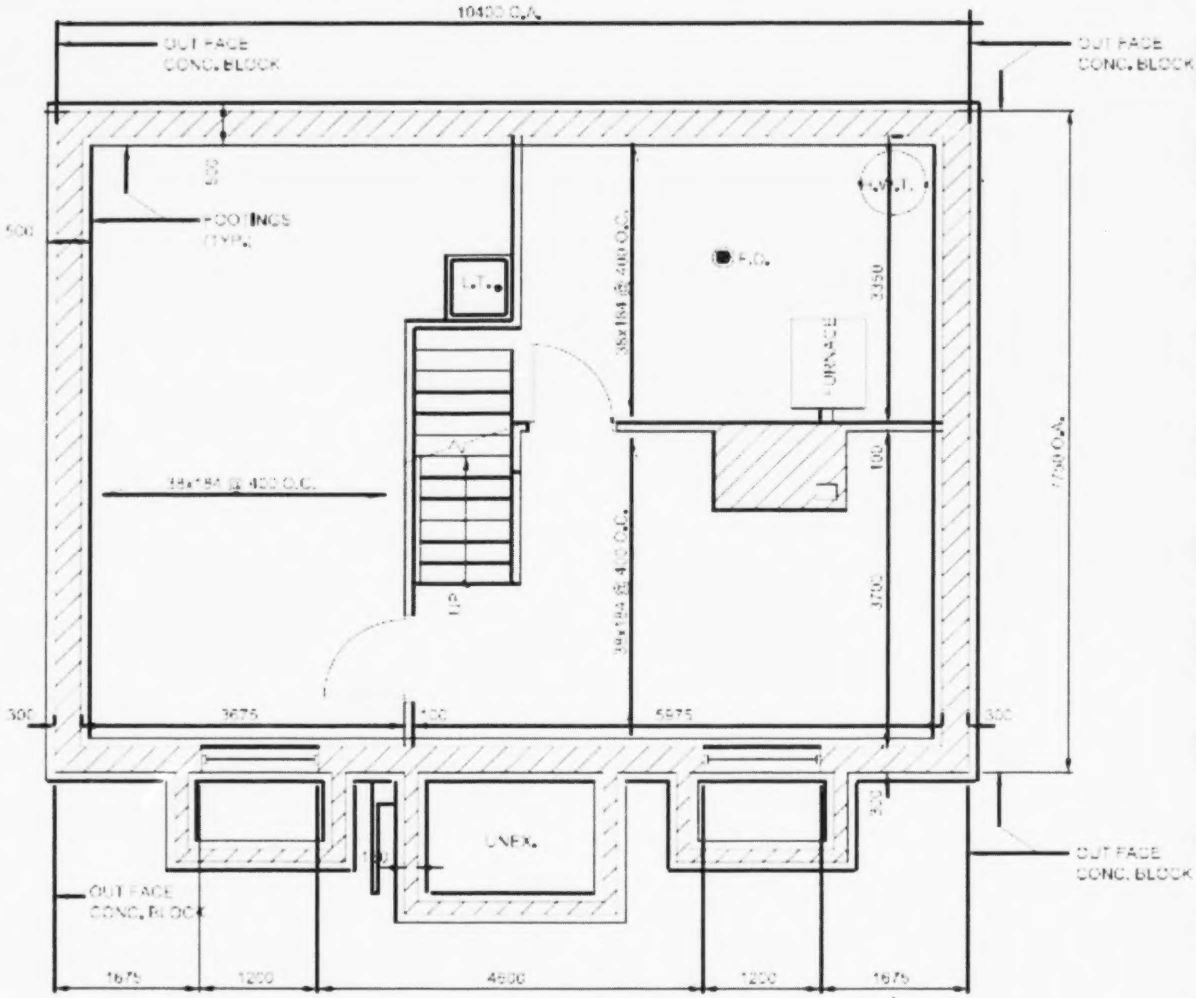


Figure 1:2 MITEC FIRST FLOOR PLAN

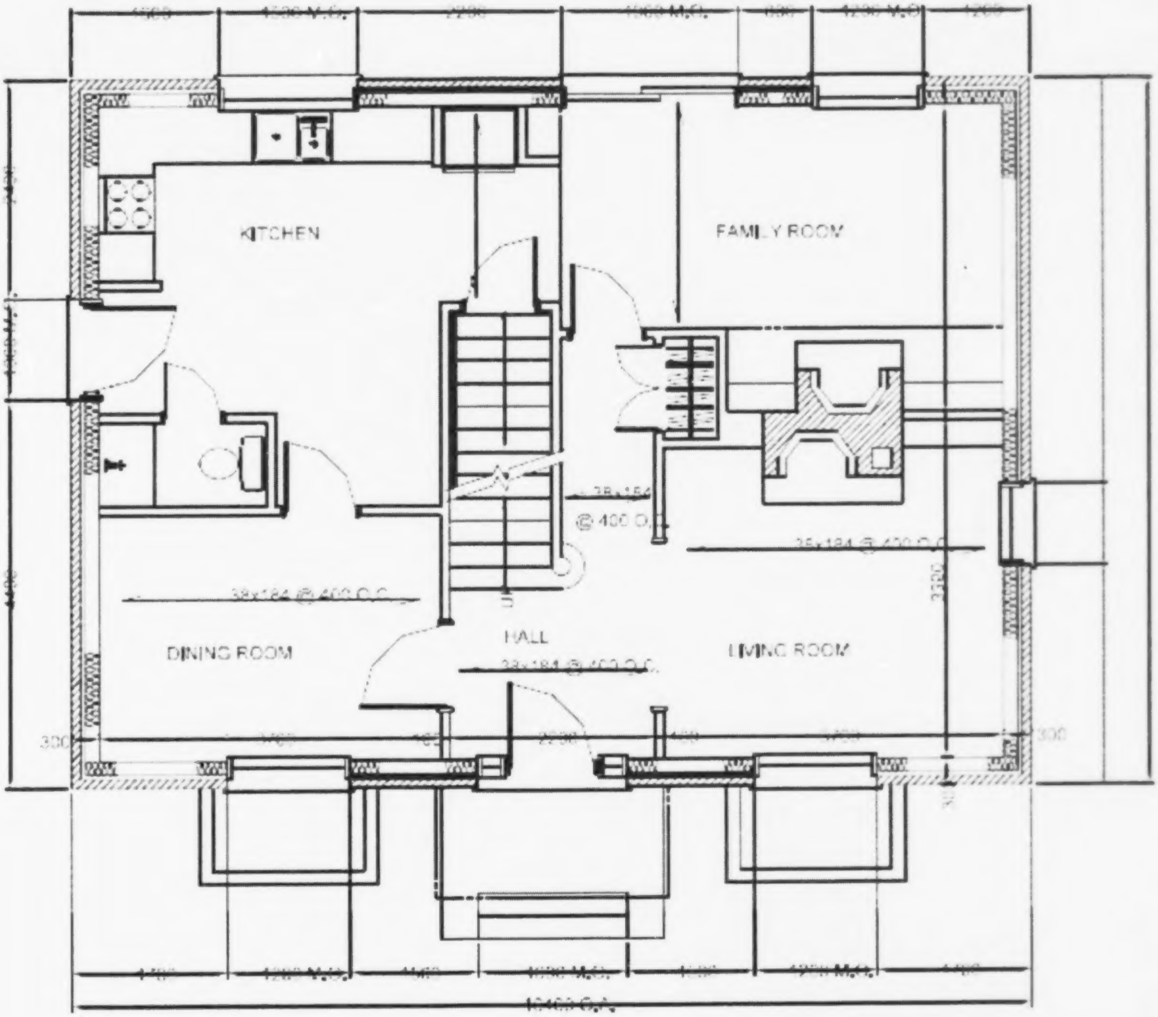


Figure 1:3 MITEC SECOND FLOOR PLAN

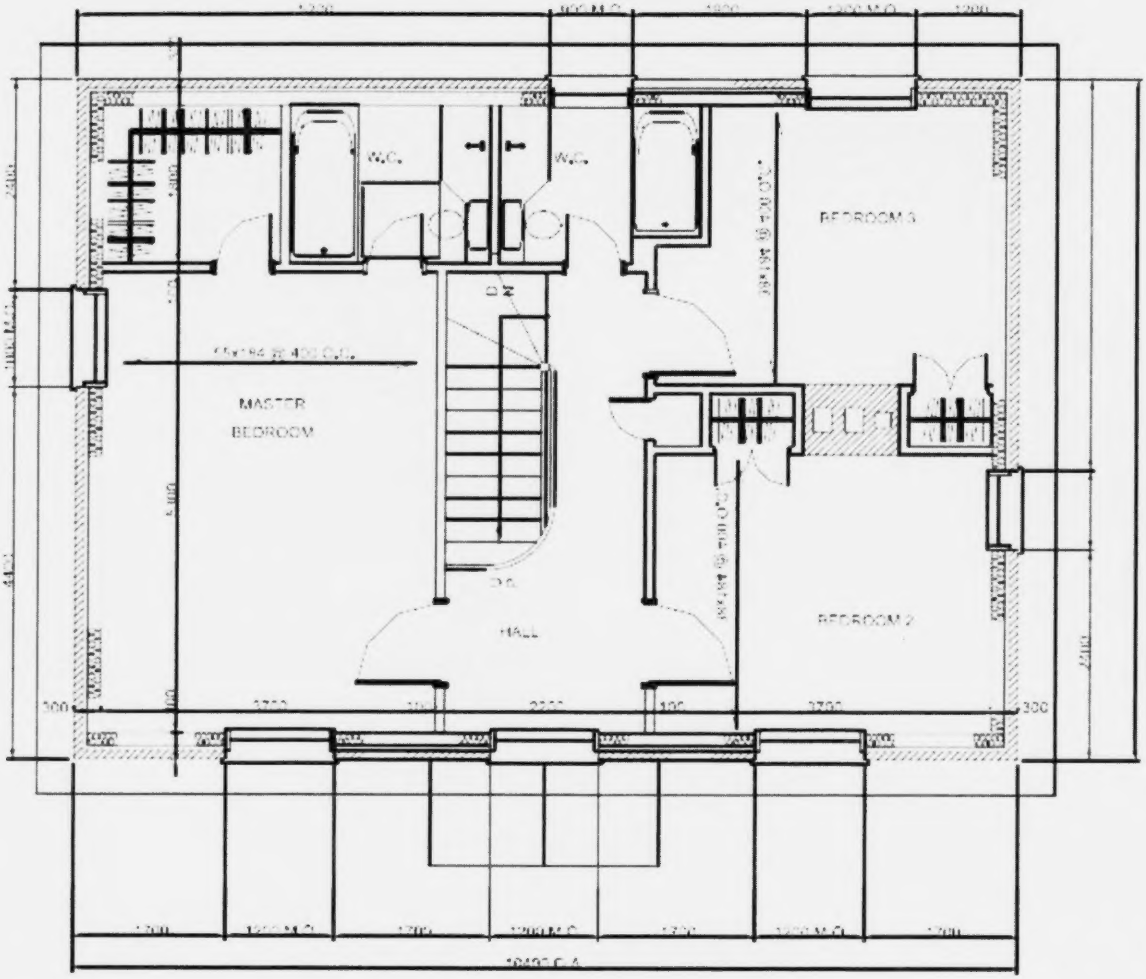
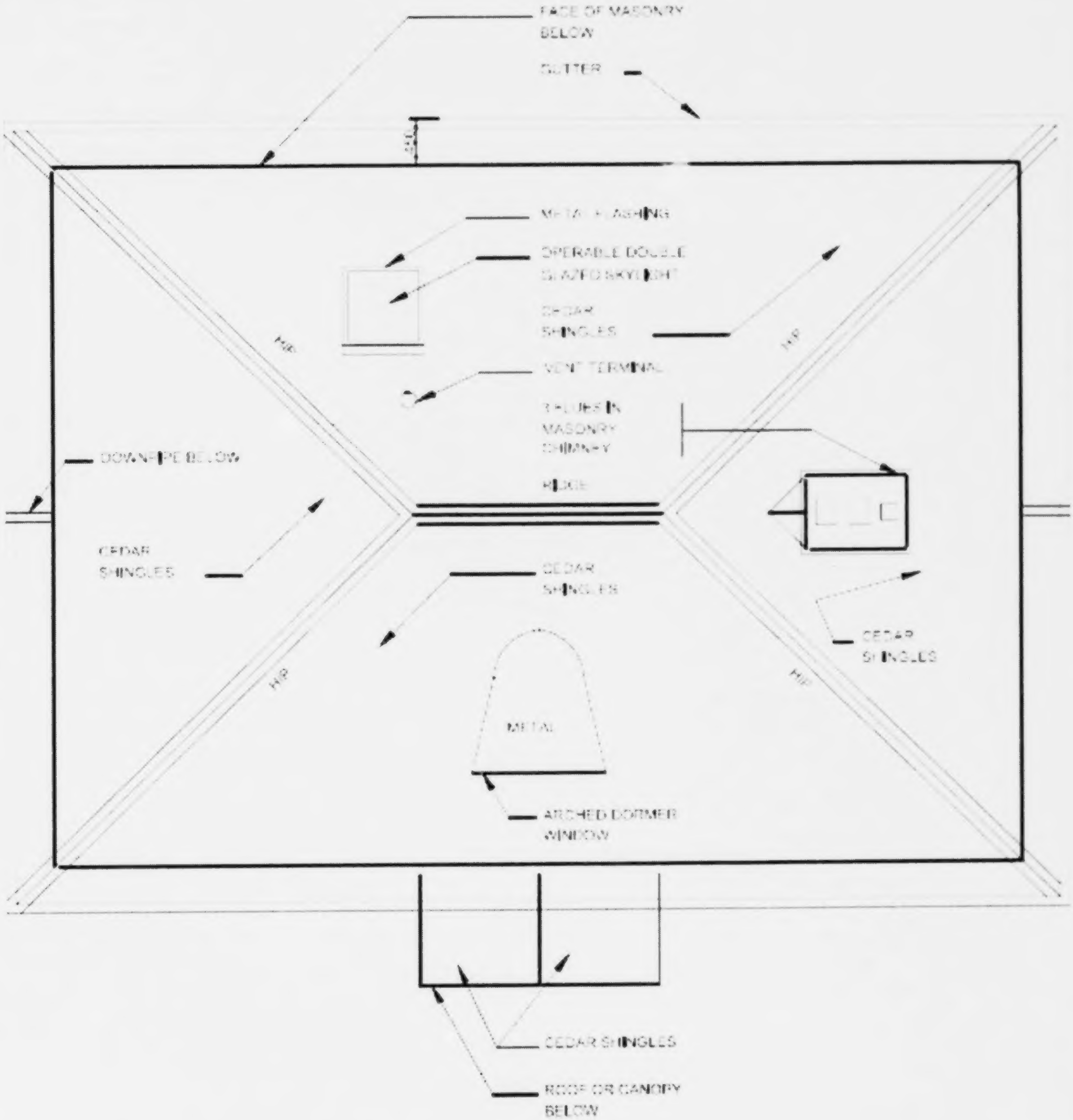


Figure 1:4 MITEC ROOF PLAN



ANSWER GUIDE

An answer guide is included at the end of this workbook.

During the class please do not look at the answer guide unless instructed by the facilitator.

If you are working on your own, you are encouraged to try each exercise and quiz yourself before turning to look at the answers.

PRE-COURSE TEST

Before you move on to the rest of this course, it will be useful to both you and the facilitator to assess how much you know about plumbing, plumbing regulation and plumbing inspection.

The pre-course test will identify areas in the course needing emphasis by the facilitator, and will give you a baseline measure to compare to your knowledge level at the end of the course.

Complete the pre-course test now. Answer each question by circling the letter beside the correct choice for each question. You have 20 minutes to complete the test.

PRE-COURSE TEST

1. The word "plumbing" is defined in:

    a) The Building Code
    b) The Ontario Water Resources Act
    c) The Building Code Act
    d) The Environmental Protection Act
    Code Ref: ________________

2. A cross-connection is:

    a) Caused by backflow
    b) Contaminated water
    c) A reversal of water in the water-distribution system
    d) A potential source of contamination of potable water

3. Private water supply means a system that supplies water from a private source to a:

    a) Water service pipe
    b) Potable water system
    c) Distributing pipe
    d) Fixture
    Code Ref: ________________

4. Which of the following pieces of legislation gives the inspector the authority to enter any premises?

    a) The Building Code Act
    b) The Ontario Building Code
    c) Municipal by-laws
    d) The Environmental Protection Act
    Code Ref: ________________

5. Which of the following can be used as a trap on a fixture in a single-family dwelling?

    a) S trap
    b) P trap
    c) Bell trap
    d) Drum trap
    Code Ref: ________________

6. What is the minimum inside diameter for a water-service pipe?

    a) 1"
    b) 3/4"
    c) 1/2"
    d) 1/4"
    Code Ref: ______________

7. Which of the following materials must *NOT* be used in the distribution of potable water?

    a) Cross-linked polyethylene
    b) Cast bronze
    c) Lead
    d) Copper
    Code Ref: ______________

8. Vertical waste pipes must be supported every.

    a) 3 metres
    b) 7.5 metres
    c) 11.5 metres
    d) Every storey
    Code Ref: ______________

9. A vent pipe must be:

    a) Provided for every trap
    b) Installed to connect as directly as possible to a vent stack
    c) Made of inflammable material
    d) Connected to a horizontal run of pipe
    Code Ref: ______________

10. What is the minimum size of soil stack to which a water closet may be connected?

    a) 1½"
    b) 2"
    c) 3"
    d) 4"
    Code Ref: ______________

11. Under Part 7 of the Ontario Building Code, which of the following materials is not permissible to be used for above-ground hot-water pipes?

    a) Copper (hard)
    b) Polyethylene (PEX)
    c) CPVC
    d) PVC
    Code Ref: ________________

12. When is a trap *NOT* required to be vented? When it:

    a) Serves a WC
    b) Is smaller than 3 inches
    c) Is made of lead
    d) Serves a storm drainage system
    Code Ref: ________________

13. What minimum size for a vent pipe that penetrates the exterior wall or roof?

    a) 1½"
    b) 2"
    c) 3"
    d) 4"
    Code Ref: ________________

14. A foundation drain:

    a) Connects the storm building drain to the foundation of the house
    b) Is part of the sanitary drainage system
    c) Refers to the pipes under the basement slab
    d) Collects water from around the foundation

15. Cleanouts are:

    a) Located at the base of every soil or waste stack
    b) Part of the water-distribution system
    c) Always found in traps
    d) Necessary on all vertical piping
    Code Ref: ________________

16. A number such as 7.6.2.4. found in Part 7 of the Ontario Building Code is referred to as:

    a) A subsection
    b) An article
    c) A sentence
    d) A clause
    Code Ref: ________________

17. Which of the following is *NOT* the responsibility of the plumbing inspector?

    a) Check compliance with the Code
    b) Inspect the work of plumbing contractors
    c) Issue Stop Work orders if the plumbing does not comply with the Code
    d) Assist the municipality in maintaining a safe and healthy environment
    Code Ref: ________________

18. Which of the following fixtures does *NOT* require a 1½" fixture outlet pipe and a ½" water supply pipe?

    a) Domestic lavatory
    b) Bathtub
    c) Laundry tub
    d) Sink
    Code Ref: ________________

19. Acceptable materials for use in a sanitary building sewer include:
    a) Copper tube M hard and cast iron
    b) PVC and galvanized steel
    c) Copper tube L hard and concrete
    d) Lead pipe and copper tube K soft
    Code Ref: ________________

20. A branch vent, stack vent, vent stack or header shall *NOT* be:

    a) Used in a single-family dwelling
    b) Less than 1½" in size
    c) Less than the size of the vent pipe connected to it
    d) Made out of PVC
    Code Ref: ________________

21. When a house is being renovated, a plumbing permit is:

a) Always required
b) Required when the existing plumbing is repaired, altered or renewed
c) Required when the amount of work to be done exceeds $500
d) Required when the work affects the municipal water supply

Code Ref: ___________________

22. Where a sump or tank receives sanitary sewage, it shall be:

a) Vented and equipped with a shut-off valve
b) Water-tight and quipped with a union and a check valve
c) Equipped with a union, a check valve and a shutoff valve on the discharge pipe
d) Vented, water- and air-tight, and equipped with a union, a check valve and a shutoff valve on the discharge pipe

Code Ref: ___________________

23. Non-potable water piping shall *NOT* be located:

a) Above living and sleeping areas
b) Above food handling equipment
c) Where it can discharge water into a sump
d) Underground

Code Ref: ___________________

24. An inspector may be liable if she or he:

a) Gives other inspectors advice
b) Paraphrases the Code
c) Certifies faulty plumbing
d) Enforces the Code

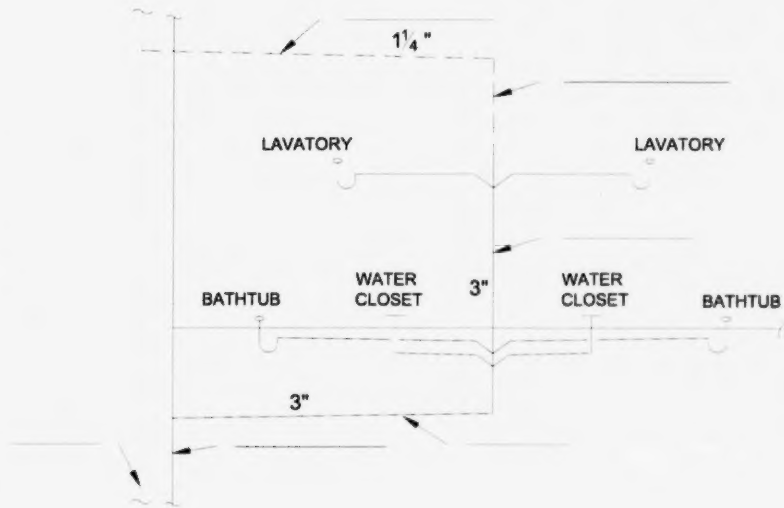
25. In order to bring an offender to court, you must use the authority of:

a) The Provincial Offences Act
b) The municipal by-law
c) The Ontario Building Code
d) None of the above are necessary

Code Ref: ___________________

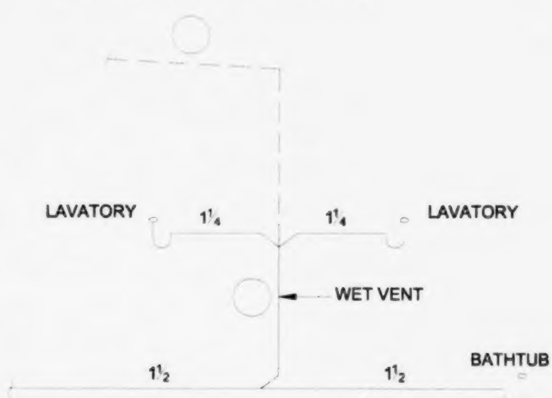
26. Label the vent and drain pipes in the diagram below.

Figure 1:5 Pre-Course Test – Vent and Drain Pipes



27. Using Table 7.5.8.3., size the following branch vent and wet vent The branch vent is 4 m in length.

Figure 1:6 Pre-Course Test – Vent Sizing



END OF MODULE 1

MODULE 2

WATER SUPPLY AND WASTE WATER MANAGEMENT

PLUMBING - HOUSE - 2007

MODULE CONTENTS Page

LEARNING OBJECTIVES

Upon completion of this module, participants will be able to:

- Examine what plumbing is and is not
- Determine whether a permit is required
- Determine the kinds of information that you may require in examining a permit application
- Examine the submitted plans to see if they are correct and correspond to the practices in your jurisdiction
- Consult the Ontario Building Code Act to see where the authorities for permits and inspections are granted

STOP

INTRODUCTION TO PLUMBING

As defined under the Building Code Act (BCA), **plumbing** is a drainage system, a venting system, and a water system, or parts thereof.

A **drainage system** is an assembly of pipes, fittings, and appurtenances on the property that is used to convey sewage and clear water waste to a main sewer or private sewage disposal system, and includes a private sewer but does not include subsoil drainage piping.

A **venting system** is an assembly of pipes and fittings that connects a drainage system with open air for circulation of air and the protection of trap seals in the drainage system.

A **water system** means a private water supply, a water service pipe, a water distribution system, a fire service main or parts of any of them.

Understanding these definitions will help you understand what a plumbing system is and what it is not.

STOP

What is NOT considered plumbing?

Other piping systems listed below are excluded from the plumbing system. A plumbing system does NOT include a system of piping:

- For space heating in which water is used as a medium to transfer heat
- In which liquids or vapours are circulated for the purpose of cooling or refrigeration
- Through which air is passed for the purpose of controlling the temperature, humidity or motion of air passing through the system
- That conveys water for the purpose of providing water or nutrients to the soil
- That conveys water for the purpose of landscaping or for the care of animals, birds or fish
- That transmits force by means of water or by means of a liquid other than water in which water is used for cooling
- That conveys liquids for the purpose of melting ice or snow
- That uses water in the conveyance of flammable gas or fuel

By definition, a plumbing system also does NOT include a well and associated devices and fittings, as follows:

- A well pump installed for the purpose of conveying water from a well
- A pressure tank and pump, if the tank and pump are combined as a unit
- The piping between any well pump and the well
- The piping between a well pump and a pressure tank that is installed separate from the pump and the connection of the piping to such pressure tank

- When there is no well pump, any piping connected to the well for a distance of 0.9 m (3 feet) from outside of the well

A properly installed plumbing system contributes to a clean environment. If you can imagine a large town or city with no provision for sanitation facilities, then you realize the significant contribution that a properly installed and maintained plumbing system makes to everyday life.

The regulations are intended:

- To ensure the health and safety of the people of the province of Ontario
- To provide uniform regulations within the province
- To maintain a high standard of installation

As this course progresses, you will see that a proper plumbing system is not a collection of pipes thrown together to remove sewage or to provide potable water, but an engineered system requiring skill and knowledge to design, install and inspect. The regulations that will be discussed are important if we are to maintain a safe environment and safe drinking water.

OBJECTIVES AND FUNCTIONAL STATEMENTS

The 2006 OBC links every technical requirement to at least one objective and one functional statement. Taking a look at some of the key objectives will help us understand the overall goals for plumbing regulations in the Ontario Building Code.

EXERCISE 2-1

Three key objectives that relate to plumbing requirements are: OH1, OH2, OP5.

Look up these objectives in Division A, Part 2, and write their title and definition in the space below.

Next, read through the sub-objectives under OH1, OH2 and OP5. Discuss with your group examples of technical requirements that might be linked to these objectives. Class discussion begins in about 5 minutes.

Title: OH1

Definition:

Title: OH 2

Definition:

Title: OP5

Definition:

STOP

YOUR LEGAL RESPONSIBILITIES

With reference to the Building Code Act, many aspects of the plumbing inspector's job have legal significance. Take some time and think about your job and the tasks you must do.

EXERCISE 2-2

What aspects of your job in accordance with the Building Code Act can be considered to be part of a legal process? Discuss this question with your group and write your answers on the flipchart. Class discussion begins in about five minutes.

Aspects of my job that are part of the legal process

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STOP

THE STATUTES AND REGULATIONS

There are three pieces of legislation that you as a plumbing inspector must become familiar with:

- Building Code Act
- Ontario Building Code
- Provincial Offenses Act

The Ontario Building Code Act gives authority in two important ways:

- To the municipality, to pass a by-law requiring permits, plans, inspections and the appointment of inspectors
- To the province, to establish the regulations that make up the Ontario Building Code

Division B, Part 7 of the Ontario Building Code applies to the design and construction of plumbing in the municipalities. A person who has been issued a building permit must notify the chief building official at a minimum number of stages during building or renovation. Division C, Subsection 1.3.5. establishes what the inspection stages are.

The Provincial Offenses Act is the procedural law used to bring cases of noncompliance to court. The penalties for installing plumbing that does not comply with the regulations are outlined in the Ontario Building Code Act; the authority to enforce these regulations, however, comes from the Provincial Offenses Act.

PERMIT APPLICATIONS AND SEWER USE BY-LAWS

Always examine the permit application with respect to the building code and your by-laws on sewer use. When the pay schedule for the plumbing permit is based on when each type of fixture is installed (i.e., on a fixture basis), it is separate from any building permit. Other municipalities combine building and plumbing permits into one permit, the cost of which is based on a percentage of the job cost. Others base their calculations on fixture unit loading.

Please note that private sewage disposal systems having a design capacity of 10,000 Litres per day or less are regulated under Division B Part 8 of the Ontario Building Code, where private sewers and private water supply are regulated under Division B, Article 7.1.5.5. of the Code.

<u>EXERCISE 2-3</u>

Read Articles 7.1.5.1. to 7.1.5.5. of the OBC and discuss these with the members of your group. Class discussion begins in 10 minutes.

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STOP

BACKFLOW PREVENTERS AND PROGRAMS

A backflow preventer is a device that prevents flowing back, or a reversal of flow that would cause contamination of a potable water system. Backflow prevention is regulated because backflow can pose a serious health hazard to humans. Backflow preventers are installed at connections to potable water systems where backflow may occur, such as at the connection to fire protection systems or to lawn sprinkler systems.

Subsection 7.6.2. governs backflow prevention for new construction and installations. For new construction, the most important Sentences are 7.6.2.1.(1) and 7.6.2.4.(2). Please read these requirements now. As you can see, the referenced documents are from the series of CAN/CSA B64 Standards that regulate different types of backflow preventers.

The degree of hazard is important to determining the type of backflow preventer required. If an inappropriate backflow preventer is installed, contamination may occur. (The best prevention is always an air gap; however, uninformed persons may alter this by attaching a hose and ending up with a direct connection.)

If the municipality intends to have a program for annual water testing, a by-law must be passed governing this. This would be the same bylaw that governs depth of service, etc. The person doing the installation and testing must be qualified to perform this kind of work.

When it has been determined that a particular installation requires a backflow preventer, it must be installed under permit; the Code provisions therefore apply. After the original installation has been correctly completed, the by-laws apply to routine maintenance and annual testing.

The items that should be noted on any report submitted to the municipality include the make and model of the backflow preventer, and its serial number; the date of the test, and the name of the person who tested it; the type of repairs, if any, that were made to ensure the device is functioning correctly; and who to contact for follow-up tests. Record-keeping will be important, if the program is to be administered consistently and follow-up inspections and reports made.

Once all the appropriate by-laws are in place, a letter to arrange the inspection is sent to the appropriate individual. An inspection is then arranged; and if any remedial action is required, a follow-up letter can be sent and a further re-inspection required.

The following two sample letters will give you an idea of what actions a municipality might take to enforce their by-laws.

SAMPLE 1: SAMPLE LETTER TO ARRANGE A PLUMBING INSPECTION

January 23, 2007

Dear Sir/Madam:

Re: Cross-Connection Control Program
123 Any Street Ave.

The protection of the potable water supply is a matter of mutual concern and benefit.

In conjunction with our Cross Connection and Backflow Control Program based on our Sewer-Use By-law and the Public Utilities Regulations By-law 98-305, our inspectors will be conducting inspections of the potable water and drainage systems under your control at the above address(es). These inspections will be carried out in the near future and we would appreciate your cooperation in this matter.

Please contact the undersigned at your earliest convenience to arrange the upcoming inspection.

Yours truly,

P.O.T. Able
Plumbing Inspector

SAMPLE 2: SAMPLE NOTIFICATION OF PLUMBING DEFICIENCIES

February 23, 2007

Dear Sir/Madam

Re: Cross-Connection Control Program
123 Any Street Ave.

A recent inspection at the above address has revealed the following situations that require correcting:

1. Mechanical Room No. 1
   A Reduced Pressure Principal backflow preventer is required on the boiler supply line.

2. Mechanical Room No. 2
   A Reduced Pressure Principal backflow preventer is required on the cooling tower supply line.

All existing or newly installed backflow preventers must be tested annually by a qualified tester, and the test report must be returned to the Building Department, Plumbing Section.

All new or replacement installations of backflow preventers will require plumbing permits to be obtained. An application may be obtained from the Building Department.

Please correct the above defects within 30 days of receipt of this letter and contact the undersigned for a reinspection.

Yours truly,

P.O.T. Able
Plumbing Inspector

PLAN EXAMINATION FOR INSPECTION OF PLUMBING SYSTEMS

The inspector's role in this is to inspect and report—not to make recommendations or design the system for the permit holder. You are there to ensure that the requirements of Section 7 of the Building Code Act are met.

Figures 2:1 and 2:2 illustrate a basic drain plan and a basic water supply plan. The details of these systems will be examined in later modules.

EXERCISE 2-4

Examine the drain plan in Figure 2:1. Does it meet the requirements for your municipality? If not, make the required corrections.

Discuss this in your group. What types of connections do you require or allow in your municipality?

STOP

Figure 2:1 Drain Plan

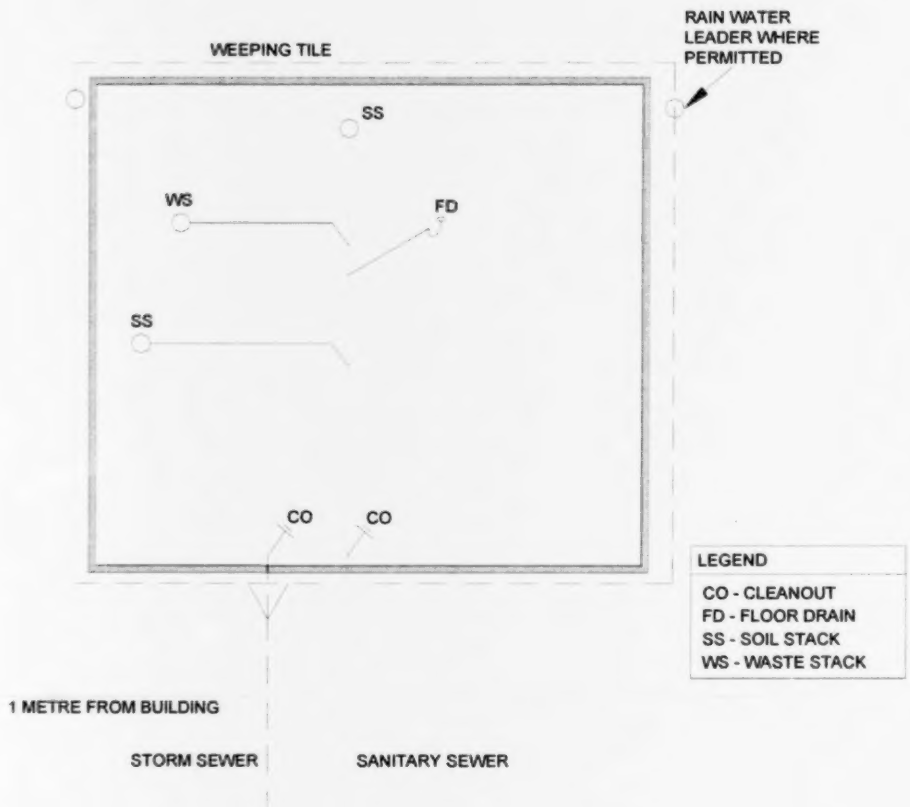
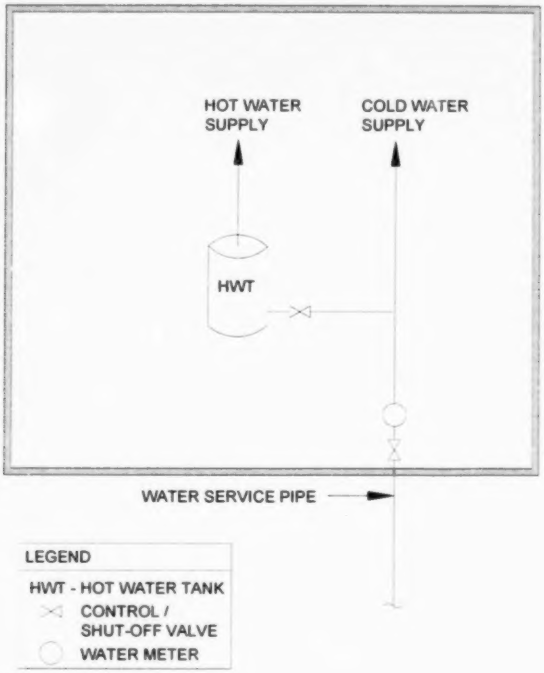


Figure 2:2 Water Supply Plan



EXERCISE 2-5: The Building Code Act

Working alone, refer to the BCA and write down the relevant sections or parts that will apply to municipalities. Class discussion begins in ten minutes.

1. Inspector appointment ______________________________

2. Enforcement ______________________________

3. Certificate ______________________________

4. By-Laws & regulations ______________________________

5. Issue of permit ______________________________

6. Conditional permit ______________________________

7. Revocation of permit ______________________________

8. Inspection ______________________________

9. Order not to cover ______________________________

10. Inspection of unsafe building ______________________________

11. Entry to dwellings ______________________________

12. Powers of inspector ______________________________

13. Warrant for entry and search ______________________

14. Disputes ______________________________________

15. Equivalents ____________________________________

16. Offences _______________________________________

17. This Act & municipal by-laws _______________________

STOP

CHECKLISTS FOR INSPECTION

The checklists on the following pages are for you to refer to as you go through this course. They don't include everything you should be looking at during inspections; you may therefore wish to expand on them to suit your own needs. As you develop your own inspection checklists during the course, compare them to what is included in your course package. Checklists are useful for ensuring that your inspections are consistent, and serve as a reminder of what you should be looking for.

CHECKLIST FOR **DRAINAGE & WATER SERVICE** INSPECTION IN A NEW HOUSE

	Nº	Inspection Item	BCA or Code Reference	Acceptable	Not Acceptable
DRAINS	1	Connection: Storm Sanitary	7.1.5.		
	2	Certification of pipe	7.2.5. to 7.2.7.		
	3	Support of pipes	7.3.4.6.(1)(2)		
	4	Slope of pipes: 3 inches or smaller, 1:50 4 inches or larger, sanitary 4 inches or larger, storm	7.4.8.1.(1) Table 7.4.10.8 Table 7.4.10.9		
	5	Testing of drains: Water Air Ball	7.3.6.2. 7.3.6.4. 7.3.6.5. 7.3.6.7		
	6	Cleanouts: Located where drain leaves building Size & spacing of cleanout	7.4.7.1.(6) 7.4.7.2.		
	7	Floor drain required Venting required Priming required	9.31.4.4.(1) 7.5.1.1. 7.4.5.5.		
	8	Extending full size (4 inches or 10 cm): Sanitary (min) Storm (min)	7.4.9.4.(1) 7.4.9.4.(2)		
WATER SERVICE	9	Water service: Material Tested Separation Frost protection Minimum ¾ inch (1.9 cm) Sized for peak demand flow	Table 7.2.11.2. 7.3.7.2. 7.3.5.7. 7.3.5.4. 7.6.3.4. 7.6.3.2.(1)		
	10	Water pipes: Material Support Valve access Lead-free solder ¾" to branch to hot water tank	 7.2.5. to 7.2.7. 7.3.4. 7.1.6.2.(1) 7.2.9.2.(2) 7.6.3.1.(4)		

CHECKLIST FOR INSPECTING **WASTE AND VENT PIPING** IN NEW HOUSING

Nº	Inspection Item	BCA or Code Reference	Acceptable	Not Acceptable
1	Testing of DWV (drain, waste, vent): Water Air Testing of water Testing of air	 7.3.6.4 7.3.6.5 7.3.7.2.(1)(a) 7.3.7.2.(1)(b)		
2	Cleanout locations at base of stacks Cleanout for kitchen sinks	7.4.7.1.(7) 7.4.7.1.(10)		
3	Pipe sizing: Stacks Horizontal branches Ejector pumps Fixture outlet pipe Stack minimum 3 inches (7.6 cm)	 7.4.10.6 Table 7.4.10.6.A 7.4.10.8 Table 7.4.10.8 7.4.10.3 7.4.9.3 7.5.7.2.(2)		
4	Grade 3 inches (7.6 cm) or less: ¼ inch per foot (1:48) Grade 4 inches (10 cm) or more	7.4.8.1.(1) Table 7.4.10.8		
5	Venting Every trap vented Wet vent size Vent terminal 1 ½ Vents on all floors Sloped, with no sags Flashings	 7.5.1.1. 7.5.2.1 7.5.6.5. 7.5.5.5.(2) 7.5.6.1.(1) 7.2.10.14.		

CHECKLIST FOR INSPECTING WASTE AND VENT PIPING
IN NEW HOUSING (continued)

Nº	Inspection Item	BCA or Code Reference	Acceptable	Not Acceptable
6	Support of all piping Vertical support Horizontal support	7.3.4.1. 7.3.4.4. 7.3.4.5.		
7	Prohibited fittings: Cross-fittings Tee fittings Restricted fittings	 7.2.4.1. 7.2.4.2. 7.2.4.4.		
8	Location of vent pipes	7.5.6.3.		
9	Certification of materials	7.2.5. to 7.2.7.		
10	Showers waterstopped	7.2.2.3.		
11	Sewage tanks and sumps: Vent size Size Union/check/valve Pump	 7.5.7.7. 7.4.6.3.(4) 7.4.6.3.(6) 7.4.6.3.(7)		
12	Water pipes: Material Support Valve access Lead-free solder ¾" to branch to hot-water tank	 7.2.5. to 7.2.7. 7.3.4. 7.1.6.2.(1) 7.2.9.2.(2) 7.6.3.1.(4)		
13	Outstanding items from drainage inspection			

CHECKLIST FOR FINAL PLUMBING INSPECTION OF A NEW HOUSE

Nº	Inspection Item	BCA or Code Reference	Acceptable	Not Acceptable
1	Final test (if required)	7.3.6.1.(2)		
2	Deviation from approved drawings	8 (12) of the Act		
3	Plumbing trim: CSA 125 approved Water efficiency	 7.2.10.6. 7.6.4.		
4	Plumbing fixtures: Trapped Removable trap or cleanout Valves on WC Drain valve Free from flaws Shower control devices	 7.2.3.1 7.2.3.1. 7.6.1.5. 7.6.1.3.(2)(3) 7.2.2.1. 7.6.5.2.		
5	Backflow preventers: On boilers On hose bibs On bidets	 7.6.2.2.(2) 7.6.2.2.(3) 7.6.2.2.(1)		
6	All cleanouts are accessible	7.4.7.4.(1) 7.1.6.2.(1)		
7	Floor drain primers are working	7.4.5.5.		
8	Hot-water tank has relief	7.6.1.12.		
9	Sign off permit			

MODULE 2 QUIZ

1. As discussed in this module, a water system includes:

   a) Only a water service pipe
   b) Only a private water supply system
   c) A water service pipe and a water distribution system
   d) A water service pipe, a private water supply, a water distribution system or any part of them

   Code Ref: ____________________

2. When a house is supplied with water from a well, but a well pump is not used, which of the following is considered to be included as plumbing:

   a) Well
   b) Water supply piping connected to a well for a distance of 3 feet from outside of the well
   c) Water supply piping starting at a distance of three feet from the building
   d) Water supply piping from the entry to the building

   Code Ref: ____________________

3. As a plumbing inspector under the Building Code Act, your legal responsibility does NOT include:

   a) Issuing permits
   b) Issuing stop work orders
   c) Inspecting building
   d) Enforcing the Building Code

   Code Ref: ____________________

4. Which document establishes the minimum number of stages that a person to whom a permit has been issued to notify the chief building official for inspection:

   a) Ontario Building Code
   b) Building Code Act
   c) Municipal By-Laws
   d) Municipal Act

   Code Ref: ____________________

5. According to Section 7 of the Building Code Act, the council of a municipality may pass by-laws to prescribe fees to:

   a) Conduct plans review
   b) Issue permits
   c) Administer and enforce the Building Code Act
   d) Conduct inspections

   Code Ref: ________________

6. No connection shall be made between a potable water system supplied with water from a water works and any other potable water system without the consent of the local:

   a) Water purveyor
   b) Plumbing inspector
   c) Health inspector
   d) Building official

   Code Ref: ________________

7. Backflow prevention devices must be selected, installed and tested in accordance with the following standard:

   a) CSA B64.6.1
   b) CSA B64.10
   c) CSA B125
   d) CSA B44

   Code Ref: ________________

8. The purpose of plumbing regulations are to:

   a) Ensure the health and safety of the people
   b) Provide uniform regulations within the Province
   c) Maintain a high standard of plumbing installation
   d) All of the above

9. If a backflow prevention program for annual testing is required by a municipality, it must be passed under the:

   a) Building Code Act
   b) Planning Act
   c) Municipal Act
   d) Health and Safety Act

10. A sewage system is regulated by the Ontario Building Code if it has a maximum design capacity of:

   a) 1,000 Litres per day or less
   b) 5,000 Litres per day or less
   c) 10,000 Litres per day or less
   d) 20,000 Litres per day or less

   Code Ref: ____________________

END OF MODULE 2

MODULE 3

THE PLUMBING MODEL: SERVICE AND DISTRIBUTION

PLUMBING - HOUSE - 2007

MODULE CONTENTS Page

LEARNING OBJECTIVES

Upon completion of this module, participants will be able to:

- Explain how a plumbing system works
- Identify the major parts of a plumbing system
- Describe how some of the parts of the system fit together
- Define some basic plumbing terms

HOW PLUMBING WORKS

There are two ways of looking at a plumbing system:

- **The order in which it is constructed** in the building—this is the way the plumbing inspector views the system. You'll be following this sequence later in the course. The problem with this approach is that it is not always clear why certain pipes are connected the way they are or how they fit into the overall plumbing system.

- **In logical order**—not how it is built, but how it works. That's how we'll be looking at it in this module. In it, you'll use a simple plumbing model to illustrate how plumbing works and how all the pieces fit together.

THE PLUMBING MODEL

The plumbing model you will see in this module is based on the MITEC house. There are two bathrooms, one kitchen, one powder room and a laundry facility shown on the plans for the MITEC house.

A basic plumbing system is quite simple: Potable water is brought into the house for a variety of uses, and the waste water is drained from the house and disposed of. From this simple description, we can divide our plumbing model into five parts.

- **Service**—bringing potable water from the source to the house. Sources include private wells, cisterns or complex municipal water systems. Water-service pipe carries the water from the source, up to and including the building control valve in the house.

- **Distribution**—moving the potable water throughout the house. Since the water is moved under pressure, strong reliable piping and joints are required. Also, water must be heated and the hot water must be distributed throughout the house through a separate set of pipes.

- **Fixtures and Plumbing Appliances**—the link between the water distribution and drainage systems. This is the most visible part of the plumbing system and includes sinks, toilets (water closets) and washing machines.

- **Drainage**—disposal of waste water. Drainage pipes large enough to transport the waste are required, with pipe joints that will not clog and traps that will prevent sewer gas from entering the house. The drainage system terminates at a point of disposal on the property, which may be a municipal sewer.

- **Venting**—connected to the drainage system. Vent pipes eliminate pressure buildup in the drainage system and carry odours away from the house. Vents provide for circulation of fresh air and maintenance of the atmospheric pressure in the plumbing system.

STOP

EXERCISE 3-1

Figure 3:1 is a diagram of a model plumbing system. On the diagram, identify each of the five parts of the system. Work alone. Class discussion starts in five minutes; be ready to state your answers.

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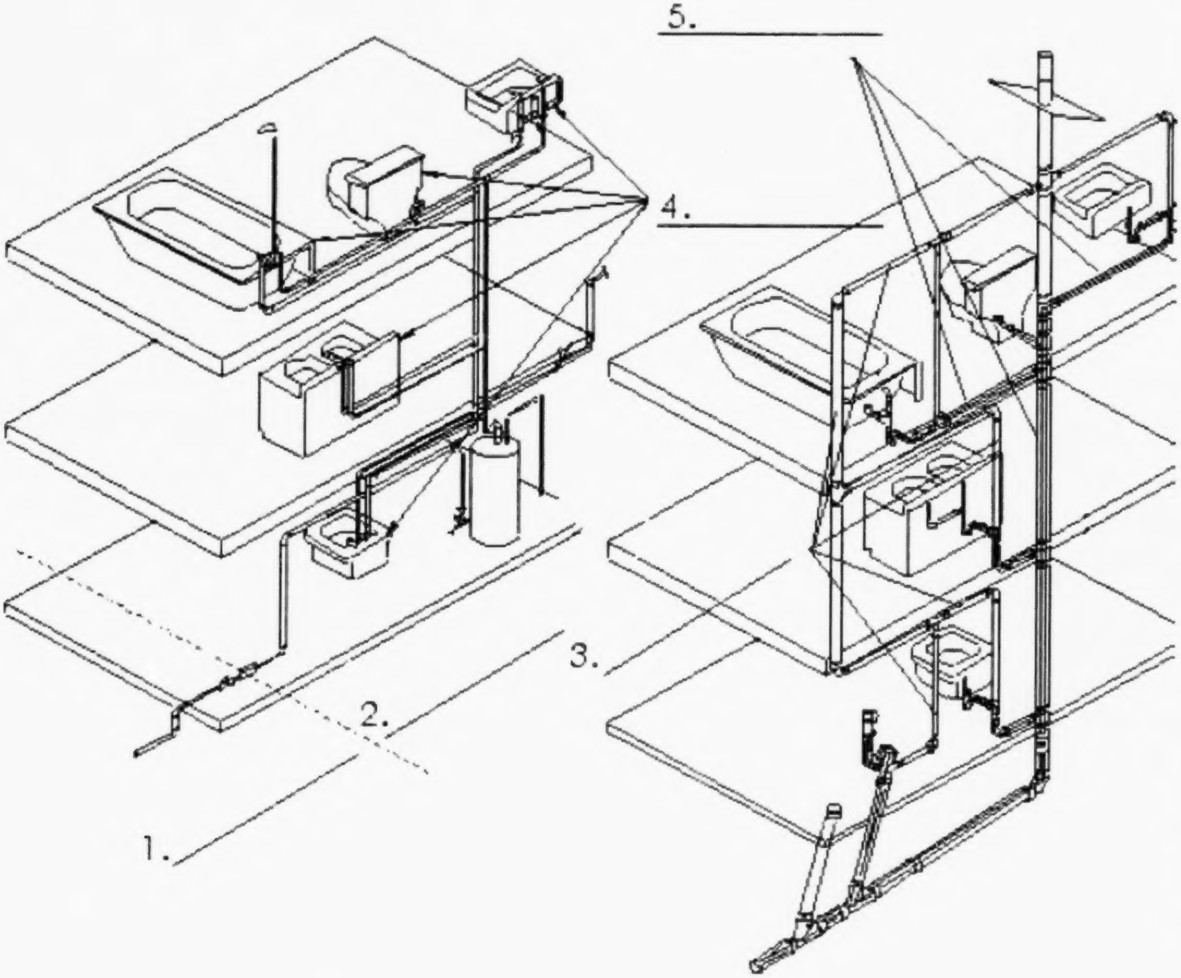
STOP

Figure 3:1 Left: Service and Distribution Right: Drainage and Venting



THE PLUMBING MODEL IN DETAIL

Now that you have a general idea of what a plumbing system is all about, let's take a more detailed look at service and drainage in the plumbing model.

Remember, this module introduces you to a basic theory of plumbing so that you'll understand how the system works. This will make the inspection process much easier to learn and carry out. It's important that you feel comfortable with the plumbing model before you get to the inspection stage, so ask questions when anything is unclear.

Depending on how much experience you have had, there may be plumbing terms that you are not familiar with. These words will be defined as you run across them, both in this section on the plumbing model and later when we deal with the inspection process. Division A Part 1 of the Ontario Building Code is a good reference when you don't know a particular word.

STOP

WATER SUPPLY SERVICE

In a private water-supply system, a well or cistern provides the water supply. A pump draws the water from the source and into the building where it is pressurized in a pressure tank.

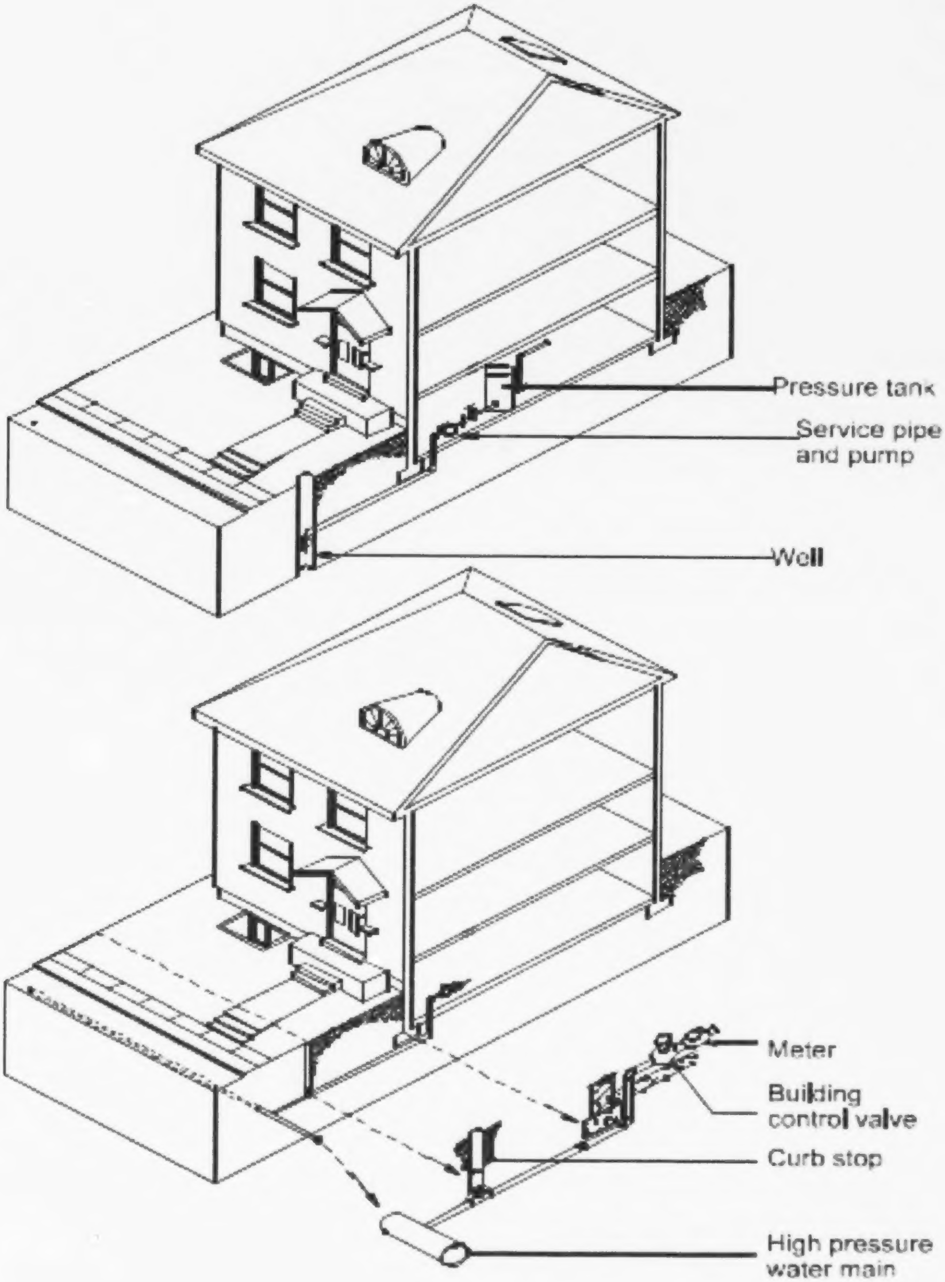
In a municipal system, the water comes from a central filtration plant, where it is directed into water mains under high pressure. A smaller pipe takes water from the main to the property line, where a curb stop is located. If the curb stop is open, water travels through a water-service pipe to the building's control valve, just inside the house. Once the water passes through the building's control valve or the meter assembly, it enters the water-distribution system.

As plumbing inspectors, your inspection job begins with the water-service pipe and follows the flow of water into the house. It is not part of your job to inspect the source of the water. However, the type of source (either private or public) will affect your inspection.

The water-service pipe brings potable water (water fit for human consumption) into the house. The two main sources of water supply are shown in Figure 3:2.

- Private—cisterns and wells
- Public—the municipal supply system

Figure 3:2 Sources of Water Supply



EXERCISE 3-2

What is the source of water in your municipality or region? Do you inspect the source? In five minutes, your group spokesperson will list your water sources on the class flipchart, along with any additional comments such as pollution problems, etc.

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STOP

DISTRIBUTION

The water-distribution system is connected to the water-service pipe at the building's control valve. The water-distribution system in a house includes:

- The water heating appliance, which heats incoming cold water
- Two sets of distributing pipes (one hot and one cold) to move the water throughout the house

It ends at the outlet from the fixture faucet or at the fittings leading to fixtures or plumbing appliances.

EXERCISE 3-3: The Pressure's Off!

After a hard day's work, you're looking forward to a nice hot shower. But when you turn on the water, it trickles slowly out of the shower head. You check the water pressure in the rest of the house and discover that it's low everywhere. What could be causing this drop in pressure?

Discuss this in your group and list possible causes. Class discussion begins in 10 minutes.

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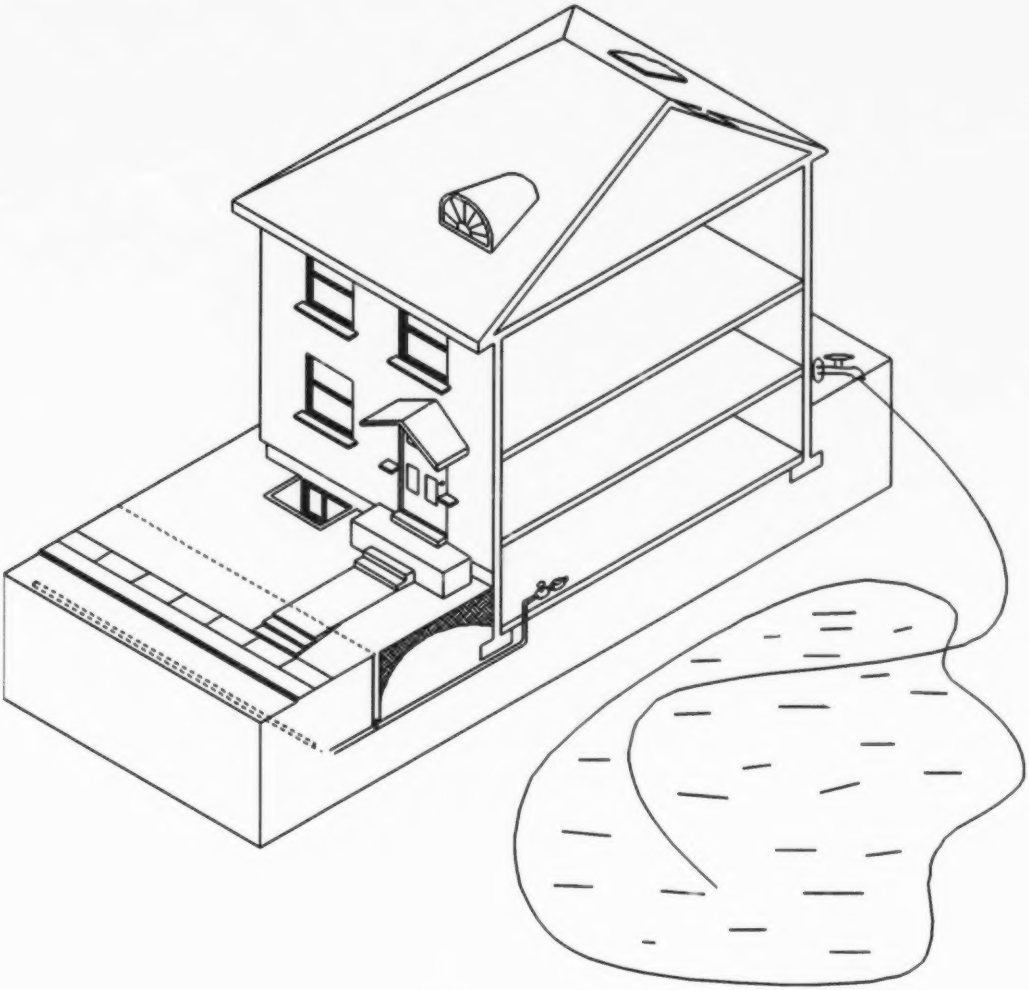
STOP

CROSS-CONNECTION

Pollution or contamination of the potable water system is a potentially serious problem in water distribution. One way that this can happen is through cross-connection. Cross-connection is any actual or potential connection between the potable water supply and a source of contamination (see Figure 3:3).

Cross-connection can cause the flow of liquids to reverse in the plumbing system. This is called backflow. It may be caused by back-siphonage, back-pressure, or a combination of both.

Figure 3:3 Cross Connection



BACK-SIPHONAGE

Back-siphonage, or siphonic backflow, happens when there is a vacuum or partial vacuum in a water supply system. It occurs when any one of the following conditions exist:

- Pressure in the water-distribution system falls below atmospheric pressure

  There are several reasons why the water pressure would fall below atmospheric pressure such as:

  - High demand (exceeding the system's capacity to supply)
  - Use of hydrants during a fire
  - Broken water mains
  - Low reservoirs

- A faucet or supply valve is open and the outlet of the faucet or supply valve is immersed in nonpotable fluid and no protection from back-siphonage is present

When any of these conditions occur, any non-potable fluid in contact with the water-distribution system can be sucked back into the distributing and water-service pipes, contaminating or polluting the water supply. A backflow occurring in this location may cause contamination of the entire water supply.

A backflow occurring in one location may cause contamination of the entire water supply.

EXERCISE 3-4: It Can Happen!

You have a new swimming pool in your backyard. After topping it up one day, you happen to leave the end of the garden hose submerged in the pool. Later, you notice that your drinking water smells and tastes like chlorine. What has happened?

Discuss, with your group, how the drinking water could have become contaminated. Class discussion begins in five minutes.

STOP

BACK-PRESSURE

Back-pressure occurs when pressure higher than the supply pressure is created in the water-supply system and causes reversal of flow into the supply. Steam or hot-water boilers, pumps, and some industrial equipment may build up sufficient pressure to cause back-pressure backflow.

Various devices can be installed in the plumbing system to prevent backflow from occurring. These will be covered in the modules on inspection.

EXERCISE 3-5

In your group, discuss situations you have encountered where cross connections have occurred. List these situations on your flipchart. Class discussion begins in 10 minutes.

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STOP

MODULE 3 QUIZ

1. As discussed in this module, water service includes:

   a) Water service piping
   b) Water source and water service piping
   c) Water source, water service piping and building control valve
   d) Water service piping, building control valve and/or meter assembly
   Code Ref: ________________

2. A plumbing inspector inspects:

   a) Water service pipe
   b) Source of water
   c) Appliances
   d) Water quality

3. Water distribution system starts at:

   a) Shut-off valve
   b) Building control valve
   c) Curb stop
   d) Exterior wall of a building

4. Cross-connection is:

   a) Connecting a horizontal supply pipe to a vertical supply pipe
   b) Connecting the hot water supply to the cold water distribution system
   c) Connection between potable water supply and a source of contamination
   d) Connection between a public storm sewer and a private storm sewer

5. A reversal of normal flow in a potable water supply caused by a negative pressure is an example of:

   a) Back-pressure
   b) Back-siphonage
   c) Back-pressure and back-siphonage
   d) Air gap
   Code Ref: ________________

END OF MODULE 3

MODULE 4

WATER SERVICE INSPECTION

PLUMBING - HOUSE - 2007

MODULE CONTENTS

LEARNING OBJECTIVES

This module covers the inspection of water service.

Upon completion of this module, participants will be able to:

- Plan and carry out an inspection of the water service piping
- Define terms related to this phase of inspection
- Identify some of the problems that you are likely to encounter on this inspection
- Determine compliance with the Ontario Building Code as it relates to water service

INTRODUCTION TO WATER SERVICE INSPECTION

Using a checklist will be useful in every type of building inspection you do.

On the job, you will probably find yourself combining the inspection of sewers and drains with the inspection of water service, since the installation of these parts of the system is likely to take place at the same time. In this module, we will first go through the inspection checklist for water service alone; then you will be asked to think about ways these two inspections can be combined.

PARTS OF THE WATER SERVICE

Use the checklist described in Module 2 to guide you through the inspections and to ensure that no important steps are missed.

The plumbing model introduced in Module 3 identified two major sources of potable water—the municipal water service and a private water supply such as a well or cistern. This module will focus on water supplied from a municipal water service.

A **water service pipe** is the pipe that conveys potable water from the source to the inside of the building. The source can be a **drinking-water system** or a **private water supply**. The Building Code defines the **water service pipe** as the portion that is on

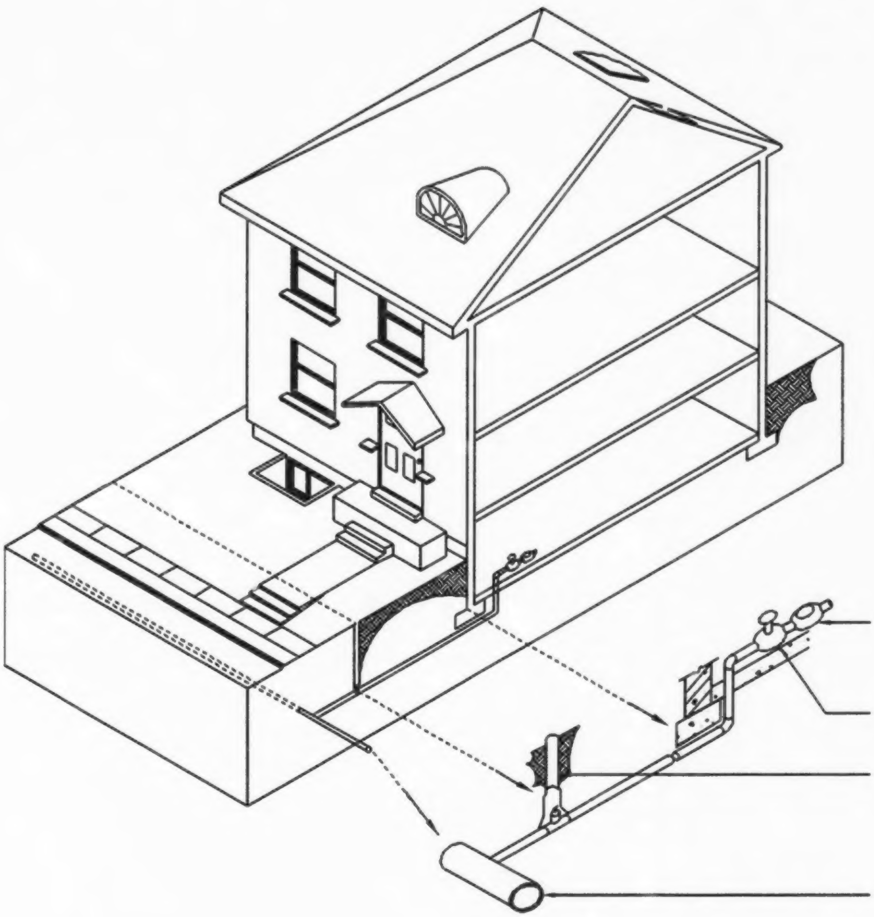
the property. These terms are defined in Division A, we will look at them after the exercise.

You will be inspecting the water service from its source to the point where it joins the water-distribution system. Figure 4:1 shows the water service piping in the MITEC house plumbing model.

EXERCISE 4-1

On Figure 4:1, label the parts of the water service. (Work on your own; you have about five minutes.)

Figure 4:1 WATER SERVICE



STOP

DEFINITIONS

The Ontario Building Code defines several terms that relate to the inspection of water service piping.

EXERCISE 4-2

Look in the "Definitions" section of Division A, Part 1and find the words related to the inspection of water service. Define the following terms in your own words, in the space provided. You have 10 minutes; work by yourself.

1. Water System:

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2. Potable:

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3. Water Purveyor:

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4. Water service pipe:

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5. Water distribution system:

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STOP

SITE CONDITION

In some municipalities, the water purveyor requires the water service piping and sanitary drainage piping to be in separate trenches. Other municipalities may permit them to lie in the same trench. See Article 7.3.5.7. of the Code on spatial separation requirements.

EXERCISE 4-3

What is the requirement for separation of water service piping and sanitary piping in your municipality? Discuss this in your group. Class discussion begins in five minutes.

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Code Ref: ______________________________________

The location of the meter/building control valve is established by the water purveyor in your region or municipality under the Municipal Act. Check with your local water purveyor to establish the location prior to your inspection.

STOP

MATERIALS

The Ontario Building Code specifies what materials are acceptable and unacceptable for the use of water service piping in a plumbing system.

Your municipality or region also regulates the materials used in water service piping. Although your municipality can pass by-laws under the Public Utilities Act controlling all phases of water service piping and may restrict the use of some materials that are accepted by your local water purveyor, it is very important to note that Section 35(1) of the Ontario Building Act states, "This Act and the building code supersede all municipal by-laws respecting the construction or demolition of buildings."

Note that the definition of building includes plumbing.

<u>EXERCISE 4-4</u>

To become familiar with the OBC requirements, go through Subsection 7.2.11. of the Code and fill in the table below. List materials that are acceptable or unacceptable to use as water service piping under the Code, and write down the Sentence or Article of the Code where you found the information.

Work by yourself; class discussion begins in 15 minutes.

Acceptable and Unacceptable Piping Materials for Water Service Piping (Section 7.2.)

Materials	Acceptable (yes/no)	Standard	Code Reference
Polyethylene			
PEX			
PVC			
PE /AL/PE			
Cast-iron soil pipe			
Galvanized steel			
Copper— K soft			
Copper— L soft			
Lead			
Materials previously used for a purpose other than distribution of potable water			

STOP

SIZING AND LOADING

Sizing is relatively simple in the water service inspection. Article 7.6.3.4. of the Code states that every water service pipe shall not be less than ¾ inch in size.

EXERCISE 4-5

When might you see a water service pipe larger than ¾ inch in size? Hint: Read Article 7.6.3.4. Work alone and write your thoughts in the space below. Class discussion begins shortly.

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Code Ref: ________________________________

VALVES AND PLASTIC PIPES

According to Sentence 7.6.1.3.(1) of the Ontario Building Code, every water service pipe must be provided with a building control valve where the pipe enters the building.

Sentence 7.6.1.3.(6) states that for the purpose of identifying the pipe material where polyethylene or PVC water pipe is used underground for a service pipe, the end of the pipe inside the building must be brought above ground for a distance not less than 300 mm and not greater than 450 mm.

<u>EXERCISE 4-6</u>

Why do you think the Code requires a building control valve, and why does it require the extension of the plastic pipe? Spend five minutes discussing the reasons in your group.

CONNECTIONS

The two main connections that you will inspect in this inspection are the connections to the municipal water service and to the building control valve.

In fact, Sentence 7.6.1.3.(5) of the OBC states that, where the water supply is to be metered, the installation of the meter (including the piping that is part of the meter installation and the valving arrangement for the meter installation) must be done in accordance with the water purveyor's requirements.

Furthermore, Sentence 7.6.2.1.(2) of the Code requires that no connection may be made between a potable water system supplied with water from a water works approved under the Ontario Water Resources Act and any other potable water system without the consent of the water purveyor.

Note that if the water service pipe is made of plastic that is suitable for cold water use only (such as PE/AL/PE composite pipe), a check valve is required on the building end of the water service pipe as per Sentence 7.6.1.10.(1)

<u>EXERCISE 4-7</u>

Some municipalities have regulations governing the type of connection allowed between the municipal water service and the water service piping. Are there restrictions in your municipality? What are they? Discuss them with your group for five minutes.

SUPPORT

Water service piping should also be supported. In most municipalities, soft copper piping is used for water service piping. Since it is fairly pliable, it does not need as much support as drainage piping.

Water service piping should be laid in a trench with a level bottom. As discussed under Site Condition, water service and drainage piping may be in the same trench or in separate trenches.

EXERCISE 4-8

What advantages and disadvantages can you think of in placing the water service and sewer pipes in the same trench? What are the implications for support? Discuss this with your group and list the pro's and cons on your flipchart. Class discussion begins in about five minutes.

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The water service pipe must be deep enough so that it will not freeze. The depth is regulated by the water purveyor and will vary from place to place, but generally should be at least 1.8 m below grade.

EXERCISE 4-9

Subsection 7.3.5. covers protection of piping. Read this Subsection and list in your own words the Articles dealing with water service piping.

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Code Ref: ______________________________________

STOP

TESTING

There are different types of tests you can apply to the plumbing system as laid out in the Code. Which tests are called for at the water service inspection? Subsection 7.3.7. may give you a clue.

EXERCISE 4-10

Decide, in your group, how to describe how to conduct the most appropriate test for this inspection. (Class discussion begins in a few minutes.)

COMMON DEFICIENCIES

There are several deficiencies that you might run across on this inspection. One of the most common is arrangement of the water service piping so that it is difficult to gain access to it. The Code addresses the installation of water service pipe under various circumstances.

EXERCISE 4-11

In your group, think of other possible deficiencies that might occur on this inspection. What have you encountered in the past? You have five minutes.

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DEALING WITH COMMON DEFICIENCIES

Once you have identified one or more of these deficiencies during your inspection, what should you do next? Remember that your job involves more than just identifying technical problems. You have to deal reasonably with the people who have caused the problems, and get them to change their work so that it conforms to the regulations.

EXERCISE 4-12

Your facilitator will choose one of the problems identified. In your group, spend five minutes discussing possible solutions. Make notes on your flipchart. One member of your group will present your approach to the rest of the class.

Notes:

DOCUMENTATION

In every inspection, you should write a report as soon as you have completed your inspection of every stage such as water supply.

STOP

MODULE 4 QUIZ

1. Which document regulates whether or not water service piping and sewer piping may be in the same trench?

   a) Environmental Protection Act
   b) Building Code Act
   c) Ontario Building Code
   d) Drainage Act
   Code Ref: ____________________

2. Under the Ontario Building Code, which materials are acceptable for use in water service piping?

   a) PVC and copper tube K hard
   b) Copper tube K soft and ¾" galvanized steel
   c) PVC and copper tube K soft
   d) Lead and copper tube K hard
   Code Ref: ____________________

3. What is the minimum size required by the Ontario Building Code for the water service pipe?

   a) ¼"
   b) ½"
   c) ¾"
   d) 1 inch
   Code Ref: ____________________

4. The Ontario Building Code requires what minimum slope for the water service piping?

   a) 1:25
   b) 1:50
   c) 1:100
   d) A minimum slope is not specified
   Code Ref: ____________________

5. The depth of the soil covering the water service pipe is regulated by:

   a) Building Code Act
   b) Water purveyor
   c) Pipe manufacturer
   d) Ontario Building Code

6. Which two tests can be witnessed during your inspection of the water service pipe?

   a) Air or hydrostatic
   b) Air and ball
   c) Smoke and water
   d) Smoke or ball

   Code Ref: ________________

7. Which of the following items contravenes the Ontario Building Code with respect to water service pipe?

   a) Piping is ¾" inside diameter
   b) Piping is made of copper tube K soft
   c) Piping is made of copper tube L hard
   d) Piping is made of ductile iron

   Code Ref: ________________

8. The inspection of water service piping is often combined with the inspection of:

   a) Sewers
   b) Stacks and wastes
   c) Venting
   d) Fixtures and plumbing appliances

9. The water service pipe inspection includes the inspection of the connection to:

   a) Plumbing appliances
   b) Municipal water service
   c) Fixtures
   d) Building drain

10. The building control valve controls the flow of:

    a) Potable water from the water service pipe to the distributing pipe
    b) Sanitary waste from the stack to the building drain
    c) Potable water from the distributing pipe to the fixtures
    d) Contaminated water into the water-supply system

    Code Ref: ____________________

END OF MODULE 4

MODULE 5

WATER DISTRIBUTION SYSTEM INSPECTION

PLUMBING - HOUSE - 2007

MODULE CONTENTS Page

LEARNING OBJECTIVES

Upon completion of this module, participants will be able to:

- Plan and carry out an inspection of the water distribution system.
- List some common water distribution problems.
- Identify compliance and noncompliance within the water distribution system.
- Define the terms related to water distribution

INTRODUCTION

This is the last inspection to be completed at the rough-framing stage of house construction. The inspection of the water distribution system is often done in conjunction with inspection of wastes and stacks and inspection of venting.

THE WATER DISTRIBUTION SYSTEM

The water distribution system is an assembly of pipes, fittings, valves and appurtenances that conveys water from the water service pipe or private water supply system to water supply outlets, fixtures, plumbing appliances and devices. "Appurtenances" means accessories, objects, or parts.

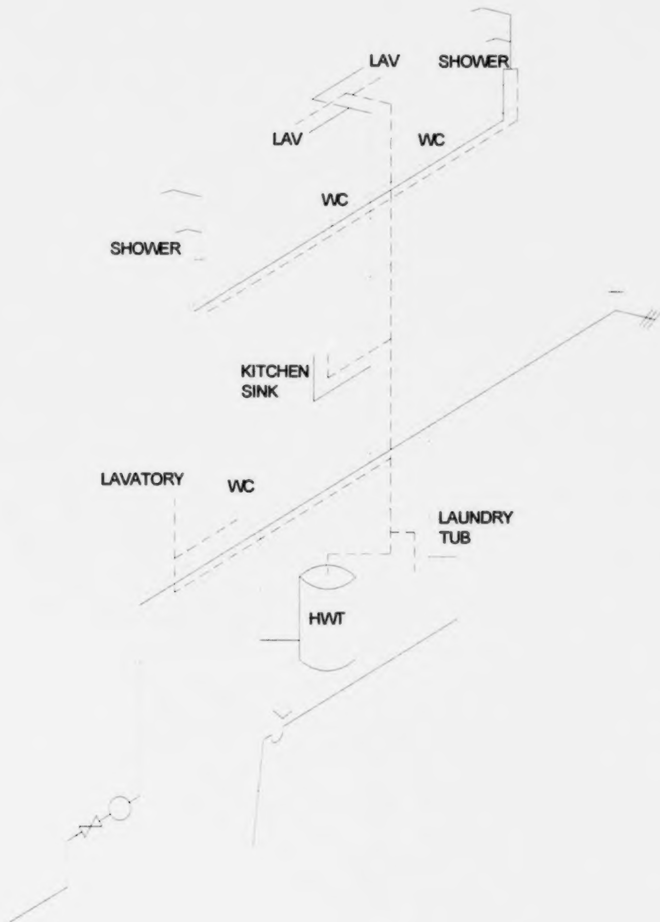
The water distribution system does not include the building control valve and/or the water meter, since these divide the distribution system from the water service pipe. A general water distribution piping layout is shown in Figure 5:1

On Figure 5:1 label the following components:

- Cold Water Supply Piping
- Hot Water Supply Piping
- Water Meter
- Building control valve
- Hose Bibb

STOP

Figure 5:1 WATER DISTRIBUTION SYSTEM



Note: Valves are not all shown in Figure 5:1 since these will be examined later in the module.

EXERCISE 5-1: Definitions

Read through the following list of terms related to the water distribution system. As there are many definitions to cover, work as a team: Each group member is responsible for three definitions. Explain your three definitions to the rest of the group and make notes of the other definitions as they are explained to you. If you cannot find a definition in the Code or Act, then the term is not specifically defined for plumbing.

Write the following definitions:

1.Air gap

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2.Backflow

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3.Backflow preventer

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4.Back-siphonage

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5.Distributing pipe

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6.Riser

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7.Vacuum breaker

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8.Water distribution system

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STOP

SITE CONDITIONS

EXERCISE 5-2: A Case of Out-of-Site

As a plumbing inspector in a small community, Pierre Lebol knows most of the contractors and plumbers who work in his area. One fellow with whom he had often worked called one day for an inspection of the distributing pipe in one of his projects.

As it was the middle of the summer and the peak of Pierre's busy season, he was unable to fit this inspection in that day—or in the next two days, for that matter. Three days later, when Pierre arrived at the site to do the inspection, he found that the contractor had begun to drywall the first floor. The contractor explained to Pierre that it was his busy season too, and if he didn't get the drywall on immediately, he would be way behind schedule.

What would you do if you found yourself in Pierre's situation? With your group, discuss possible courses of action and which ones are the most appropriate. Write the major points on the flipchart.

What I would do if the plumbing to be inspected was partially covered:

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STOP

MATERIALS

The Ontario Building Code is very specific about the materials that can be used for the distributing pipe because of the risk of contamination to the potable water supply. The following types of piping materials are acceptable in a water distribution system:

- Cast iron (ductile or gray iron)
- Copper
- Brass
- CPVC
- PEX, cross-linked polyethylene
- PE/AL/PEX
- PEX/AL/PEX
- Polypropylene PP-R

Note: Some of the materials may only be permitted for cold water system.

Polybutylene and aluminium are no longer permitted in the OBC for water distribution piping.

In addition to requirements specific to types of materials, Sentence 7.2.1.2.(1) of the Code states that used materials and equipment, including fixtures, may not be reused unless they meet the requirements of this part for new materials and equipment, and are otherwise satisfactory for their intended use.

Furthermore, materials and equipment that have been used for a purpose other than the distribution of potable water cannot be used subsequently in a potable-water system.

Article 7.2.1.3. deals with identification and certification of plumbing components including pipes and fittings. Read this article now.

NON-METALLIC MATERIALS

The use of polyethylene water pipe or tube is regulated by Sentence 7.2.5.5.(2) of the Code, which restricts its use to water service pipe. Remember, a check valve is required under Article 7.6.1.10. of the OBC.

However, Article 7.2.5.7 permits the use of cross-linked polyethylene pressure pipe or tube and fittings used in aboveground or underground installation in water service pipe or distributing pipe, provided they are certified to the CAN/CSA-B137.5 Standard (i.e., PEX type).

Note that this standard also contains installation requirements.

Sentence 7.2.5.9.(2). regulates the use of CPVC in hot- and cold-water pipes, provided the design temperature and pressure of such piping conforms to the CSA B137.6 Standard.

EXERCISE 5-3: Non-metallic Pipe Materials

Article 7.2.5. sets out the regulations for the use of water distribution piping materials. In the chart below fill in a "Yes" if it is permitted and a "No" if it is not permitted along with the appropriate code reference.

Acceptable and Unacceptable Piping Materials for Water Distribution (Subsection 7.2.5.)

Materials	Cold	Hot	Code Reference
Polyethylene (PE)			
Chlorinated Poly Vinyl Chloride (CPVC)			
Cross-linked polyethylene (PEX)			
Polypropylene (PP-R)			
Acrylonitrile-Butadiene-Styrene (ABS)			
Polybutylene			

STOP

FERROUS PIPING

In older homes, copper and galvanized steel are the materials most commonly used in distribution pipe. In Article 7.2.6.7., the Code now stipulates that welded or seamless steel pipe may not be used in a plumbing system, except for:

- Galvanized steel pipe used in a drainage or venting system above-ground inside a building
- Galvanized steel pipe used in buildings of industrial occupancy
- Welded or seamless steel pipe used for the purpose of repairing an existing galvanized steel piping system

NONFERROUS PIPING

Table 7.2.7.4. of the OBC tells you what kind of copper tubing can be used above and below ground in the water distribution system. The different letter designations refer to the thickness of the wall of the tube. When selecting hangers to support copper tubing, it is important to choose those that avoid galvanic corrosion (see Article 7.3.4.3., Insulation of Support). Alternatively, the piping/hanger can be electrically insulated (i.e. wrap around with duct tape).

Article 7.2.7.6. of the Code also regulates the solder joint fittings for nonferrous materials in the water system. They must conform to either of:

- ANSI Standard B16.18, Cast Copper Alloy Solder Joint Pressure Fittings, or
- ANSI Standard B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

However, solder joint fittings for water systems not made by casting or the wrought process must conform to ANSI Standard B16.18., Cast Copper Alloy Solder Joint Pressure Fittings.

Finally, lead waste pipes and fittings must not be used in a water distribution system.

SIZE AND LENGTH OF WATER DISTRIBUTION PIPING

Subsection 7.6.3. contains the requirements for the size and capacity of water distribution pipes.

EXERCISE 5-4

Read Subsection 7.6.3. through before you go on to answer these questions. Do the exercise by yourself; then compare your answers with those of your group members.

1. What is the minimum diameter of a distributing pipe that connects the water service pipe to the first branch supplying the hot-water heater?

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Code Ref: __________________________________

2. What is the basic rule for sizing a pipe that supplies water to a water closet with a flush tank?

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Code Ref: __________________________________

3. If a distribution pipe is connected to a tail piece or connector that is smaller that supplies water to a fixture, what is the longest the tube can be and what is the minimum size?

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Code Ref: __________________________________

4. What is the minimum pipe size for a hose bibb?

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Code Ref: ______________________________________

5. What size must the pipe supplying water to a dishwasher be?

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Code Ref: ______________________________________

STOP

HYDRAULIC LOAD

Loading for water distribution pipes is covered in the 2006 Ontario Building Code. However, the specific design procedure for sizing water distribution pipes is not covered by the OBC. However, Article 7.6.1.1. of the Code requires that potable water systems be designed, fabricated and installed in accordance with good engineering practice and the ASHRAE guidelines. If the system serves a house, a designer can design and size the system. A professional engineer is required where the water distribution system serves large buildings, and/or buildings with assembly or institutional occupancies as defined in Division C, Section 1.2.

Sentence 7.6.3.1.(1) of the Code states that pipes in a water distribution system must be designed to provide peak demand flow at the required flow pressures. However, this requirement is not applicable to single dwelling units under Sentence 7.6.3.1.(3).

SLOPE OF WATER DISTRIBUTION PIPING

Article 7.6.1.2. requires a water distribution system to be installed so that the system can be drained or blown out with air.

Outlets for this purpose must be provided:

- A drain port must exist downstream of the building control valve-7.6.1.3.(2)
- If there is a water meter, the drain port must be downstream of the meter- Sentence 7.6.1.3.(2)
- Where the building control valve is 1" in trade size or smaller, the valve and drain port may be combined in the form of a stop and waste valve—Sentence 7.6.1.3.(3)

<u>EXERCISE 5-5</u>

Discuss the following questions within your group.

1. Why have the requirements in 7.6.1.2. been included in the Code?

2. Can you foresee any problems in gaining compliance with this? If so, what problems might occur? How could this be addressed?

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STOP

CONNECTIONS

The water distribution system connects to the water service pipe and to fixtures and outlets. Article 7.1.5.3. of the Code requires every water distribution system to be connected to a water main that is part of a municipal drinking water system or, if there is no public water main, a drinking water system. The connection between the water distribution system and the public water main is made via a water service pipe.

In addition, Section 7.7. prohibits any connection between a non-potable and a potable water system. It also restricts locations for non-potable water systems and requires that non-potable-water piping be identified by markings that are permanent, distinct and easily recognized.

EXERCISE 5-6

Why are these matters in Section 7-7 regulated by the Code? Take a few minutes and discuss this with your group.

1. Why are there restrictions for the locations of non-potable water piping and discharge outlets and for marking the pipes?

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2. Why is it important to keep potable and non-potable water from serving the same fixture?

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CROSS CONNECTIONS

Avoiding the contamination of the potable water supply is a critical issue in the maintenance of health and safety in a community.

Back-siphonage occurs where a vacuum in the water-supply system causes contaminated water to be drawn into the potable water supply. This type of backflow can occur when a hose is left in non-potable water and the municipal pressure drops, for example see Figure 5:2.

All backflow preventers must be selected, installed & field tested in accordance with the CSA B64.10-01 standard, unless otherwise stated in the OBC. Many municipalities are passing by-laws requiring re-inspection & testing of backflow preventers after they have been installed.

One potential problem with the installation of a backflow preventer (or check valve for plastic service pipe) is that it creates a closed piping system. A closed piping system cannot accommodate the increase in pressure caused by thermal expansion. The methods of countering this are:

- A thermal expansion relief valve or device set at a pressure of no more than 550 kPa (80 psi) and designed for repeated use.

- A suitably sized diaphragm expansion tank designed to be used with potable water

The expansion tanks should be installed on the cold water side of the hot water tank. If nothing is done to counter-set the thermal expansion, there is a chance that pressure may reach an unacceptable level. The relief valve on the hot water tank may discharge. The relief valve is not designed to be operated on a continuous basis.

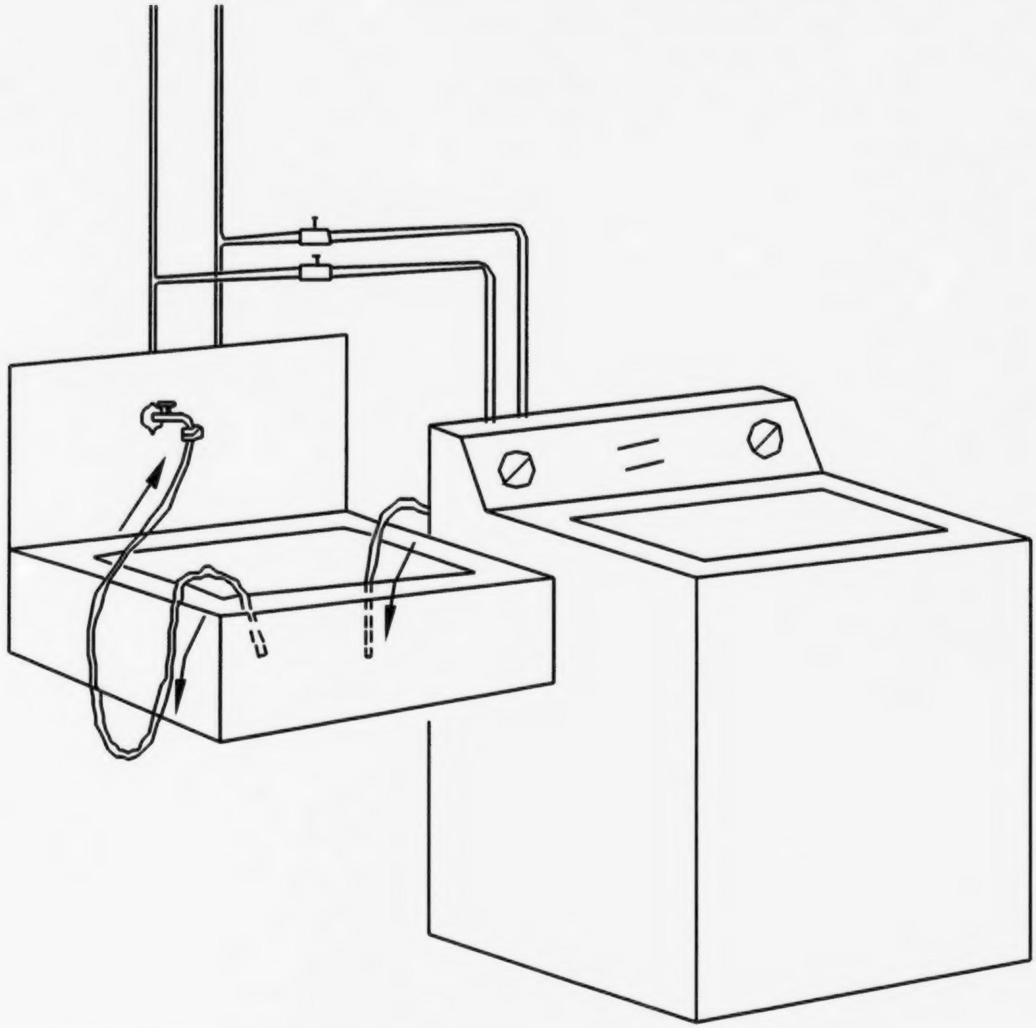
Protection against thermal expansion is required by Article 7.6.1.16 when any of the following are installed:

- A check valve required by Article 7.6.1.10.
- A backflow preventer required by Article 7.6.2.2.
- A pressure reducing valve require by Article 7.6.3.3.

Because backflow is such a serious problem, there are a number of requirements for protecting the potable water system against contamination. Read Subsection 7.6.2. to prepare yourself to answer the questions in Exercise 5-7.

STOP

Figure 5:2 POTENTIAL CROSS-CONNECTION



In this situation, contamination of the potable water supply can occur if:

- water from the washing machine is in the laundry tub and the end of the tubing from the faucet is submerged,
- the faucet is open, and
- there is reduced pressure in the water supply piping, causing contaminated water to enter the potable water system.

EXERCISE 5-7: Backflow and Backflow Preventers

Do this exercise on your own and then discuss your answers with your group. Correct your own papers.

1.a) What is an atmospheric vacuum breaker?

b) How must one be installed?

2. If you have the minimum size of distributing pipe serving a kitchen sink, what must the minimum height of the air gap be?

Code Ref:

3. Must every hose bibb be fitted with a backflow preventer?

Code Ref:

4. When is a backflow preventer necessary?

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Code Ref: ______________________________________

STOP

SUPPORT

Turn to the Subsection 7.3.4. on "Support of Piping" and read it through again. This time, look for the regulations that apply to the water distribution system.

EXERCISE 5-8

Make a note of the articles or sentences that apply to the water distribution system below, and write a brief summary of what they regulate. You will be able to use this material later on the job.

The requirements in the Code that are relevant to the support of water distribution pipe:

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Code Ref:__________________________________

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Code Ref:__________________________________

Code Ref:

Code Ref:

Code Ref:

STOP

OTHER ISSUES

Subsection 7.6.1. of the Ontario Building Code has not been covered under any of the checklist items, but you must be familiar with it to carry out your inspection.

Article 7.6.1.1. deals with the **positioning of hot- and cold-water pipes**, which must conform to the following Sentences:

- **Every fixture** supplied with separate hot- and cold-water controls shall have the **hot water control on the left** and the **cold on the right**.

- Where hot and cold water are mixed and the temperature is **regulated by a single, unmarked, manual control**, a movement to the **left shall increase the temperature**, and a movement to the **right shall decrease the temperature**. (See also requirements on shower valves - Article 7.6.5.2.)

SHUT-OFF VALVES

The shut-off valve, as the name implies, is a **control device** that allows the **flow of fluids in a pipe** to be **impeded or discontinued**. The following are some of the related regulations contained in the Code:

Every valve in a plumbing system shall be so located that it is **readily accessible** for use, cleaning and maintenance—Article 7.1.6.2.

- **Every pipe** that is supplied with water from a gravity water tank or a tank of a private water supply system shall be **provided with a shut-off valve** located close to the tank—Sentence 7.6.1.3.(4).

- Except for a single-family dwelling, **every riser** shall be provided with a **shut-off valve** at the source of supply—Article 7.6.1.4.

- **Every water closet** shall be provided with a **shut-off valve** on its water supply pipe—Article 7.6.1.5.

- **Every water pipe that supplies a hot water tank, pressure vessel, plumbing appliance or water using device** shall be provided with a **shut-off valve** located close to the hot water tank, pressure vessel, plumbing appliance or water using device—Article 7.6.1.8.

- **Every pipe that passes through an exterior wall** to supply water to the exterior of the building shall be provided with a **frost-proof hydrant or a stop-and-waste cock** located inside the building and close to the wall—Sentence 7.6.1.9.(1).

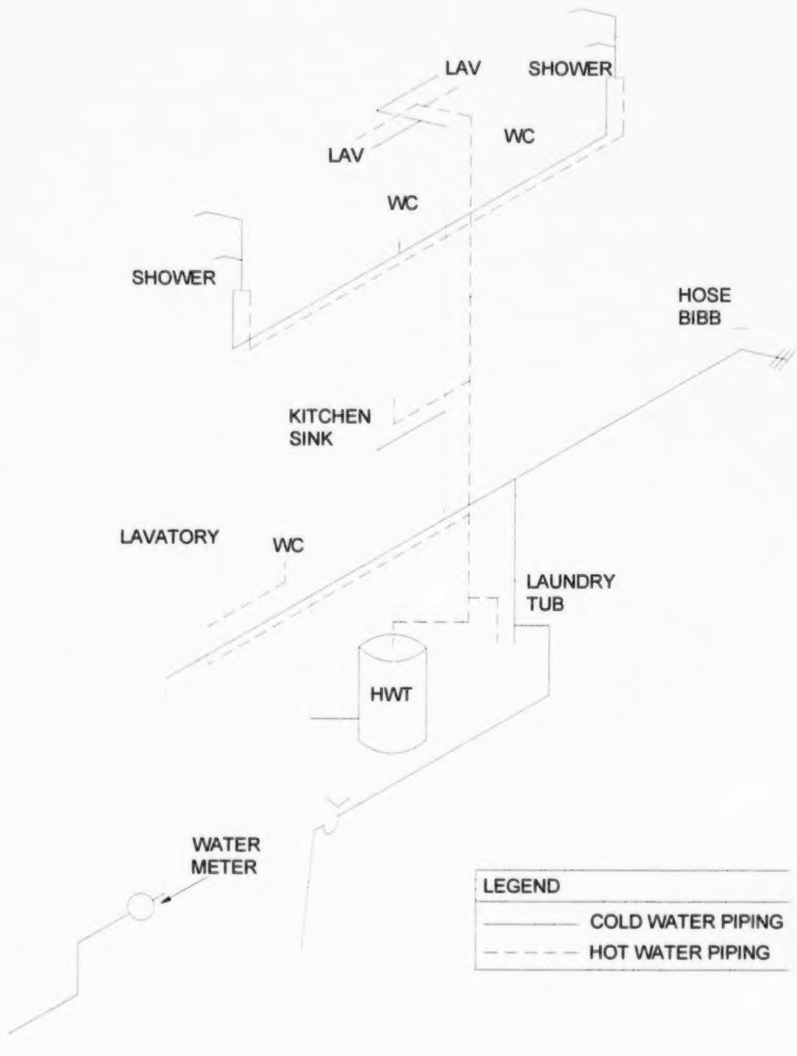
- **No shut-off valve** shall be installed **on the pipe between any tank and the relief valves or on the discharge lines** from such relief valves—Sentence 7.6.1.12.(7).

STOP

EXERCISE 5-9

Using some of the above regulations, identify the location of all the required shut-off valves on the diagram of the MITEC house on Figure 5:3. Refer to the section above and to Subsection 7.6.1.

Figure 5:3 SHUT-OFF VALVES ON WATER DISTRIBUTION PIPES (Ex. 5-9)
(Reference Article 7.6.1.3. for the required location of Control and Shut-off Valves.)



EXERCISE 5-10: Arrangement of the Potable Water System

Read through the rest of Subsection 7.6.1. and then answer the following questions. Do the exercise on your own and then discuss your answers with your group.

1. Why would it be necessary to have a check valve installed at the building end of a cold-water service pipe when the pipe is made of plastic?

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Code Ref: ______________________________

2. What size must the pipe be that conveys water from a temperature and pressure relief valve, a pressure valve or a temperature relief valve?

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Code Ref: ______________________________

3. Where may you not install a shut-off valve?

Code Ref:

4. Where may a building control valve and drainport be combined in the form of a stop-and-waste valve?

Code Ref:

5. What is the maximum internal pressure allowed in a hot-water pressure tank connected to a plumbing system?

Code Ref:

6. Describe how a pipe serving a relief valve on a hot water tank is required to terminate.

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Code Ref: ______________________________________

STOP

COMMON DEFICIENCIES

A number of problems are commonly found in the water distribution system. The following points are a few of the contraventions you may encounter.

- Backflow preventers missing from hose bibbs—Sentence 7.6.2.2.(3)
- Sagging pipes due to inadequate support—Sentence 7.3.4.1.(1)
- Insufficient expansion holes left in joist causing distributing pipes to bow—Article 7.3.3.9.

EXERCISE 5-11

Examples of common contraventions are listed above. Within your groups, take 15 minutes to come up with some more. Develop your list on the flipchart.

Notes—common deficiencies in the water distribution system:

STOP

TESTING

Subsection 7.3.7 tells you that one of two tests can be done on the potable water system.

Filling out the following chart will help you to understand when and how each test should be conducted and the differences between the two tests.

EXERCISE 5-12

Tests For Potable Water System Subsection 7.3.7

	Water Test	Air Test
Climatic condition		
Pressure		
Duration		
Test medium		

DOCUMENTATION

EXERCISE 5-13

As with your earlier inspections, the inspection of the distribution piping should also be documented.

Think about what information should appear in your report from this inspection, and write this below.

STOP

EXERCISE 5-14: Checklist

Within your group, take the next ten minutes to add to the checklist that you devised in Module Two and come up with something that will help you to do all water supply inspections.

On this checklist, make sure that you indicate the sections of the Code that you will need to reference. Write the checklist on the flipchart.

Your answers should be easy to use, so do not rewrite the regulations contained in the Ontario Building Code on your checklist. This exercise will help you review for the test.

Checklist for Inspections

STOP

MODULE 5 QUIZ

1. The water distribution system is an assembly of piping that conveys water from:

   a) A hot water tank
   b) The municipal system
   c) The water service pipe
   d) A well
   Code Ref: ________________

2. An air gap

   a) Is a bubble in a stream of water
   b) Is the unobstructed distance between a drainage pipe and the flood level rim of a fixture
   c) Causes water hammer in a plumbing system
   d) Is the unobstructed distance between a faucet and the flood level rim of a fixture
   Code Ref: ________________

3. Which of the following is a term associated with the water distribution system:

   a) Air gap
   b) Air break
   c) Curb stop
   d) Building control valve
   Code Ref: ________________

4. Which of the following materials must NOT be used in the water distribution system:

   a) CPVC
   b) Copper (M hard)
   c) Copper (M soft)
   d) Ductile Iron
   Code Ref: ________________

5. Which of the following statements is NOT true for a single family dwelling:

   a) Every riser shall be provided with a shut-off valve at the source of supply
   b) Every water closet shall be provided with a shut-off valve on its water supply pipe
   c) No shut-off valve shall be installed on the pipe between a hot water tank and its relief valve
   d) A check valve is required for a cold water use-only water service pipe

   Code Ref: ___________________

6. The minimum size of a distributing pipe which connects to the first tee serving the hot water tank is:

   a) 1¼ inches
   b) ½ inch
   c) ¾ inch
   d) 1 inch

   Code Ref: ___________________

7. A water distribution system shall be installed so that:

   a) It will pass the ball test
   b) The system can be drained
   c) The flow of water to the fixtures will be assisted
   d) Future modifications are facilitated

   Code Ref: ___________________

8. Non-potable water piping shall NOT be located:

   a) where food is prepared in a food processing plant
   b) above food handling equipment
   c) where it can discharge into a sink
   d) All of the above

   Code Ref: ___________________

9. Which of the following is not a type of cross-connection:

    a) Inlet connection
    b) Indirect connection
    c) Pressure connection
    d) Direct connection

10. The hot- and cold-water pipes must be connected to fixtures so that:

    a) The control for the hot water is on the left; and for the cold, on the right
    b) Every fixture has a separate hot and cold water control
    c) Hot and cold water controls are well marked
    d) The temperature increases and decreases at regular interval

    Code Ref: ____________________

END OF MODULE 5

MODULE 6

DRAINAGE

PLUMBING - HOUSE - 2007

MODULE CONTENTS Page

LEARNING OBJECTIVES

Upon completion of this module, you will be able to:

- Identify major parts of a plumbing system.
- Describe how the parts of the system fit together.
- Define some basic plumbing terms.
- Understand the objectives behind key drainage requirements

THE DRAINAGE SYSTEM

Once water has been used for some purpose, it must be drained from the fixture or plumbing appliance and disposed. The overall drainage system is composed of two parts: the sanitary system and the storm system. Venting is an integral part of the drainage process; but because it has specific functions, it is dealt with separately.

Let us look at a drainage system in general. It begins with the fixture drains and ends at the connection to the point of disposal on the property. It includes a number of elements: **fixture drains, traps, soil and waste stacks, cleanouts, and drainage piping.**

Drainage systems are addressed primarily in OBC Division B, Section 7.4.

The objectives of the 2006 OBC are set out in Division A, 2.2.1.1(1). Some objectives that generally relate to drainage are listed below.

These are presented here to give you a general idea of what the Code is trying to accomplish with the regulations to govern the drainage system. **It is not necessary to review objectives and functional statements in detail in this course.** Other technical courses will address how to use objectives and functional statements.

<u>EXERCISE 6-1</u>: Objectives and Functional Statements

Complete the following exercise by filling in the blanks, and then discuss your answers with your group. The first objective is completed as an example.

OBJECTIVE NO.	OBC OBJECTIVE
OH1.1	An objective of this Code is to limit the probability that, as a result of the design or construction of a building, a person in the building will be exposed to an unacceptable risk of illness due to indoor conditions caused by inadequate indoor air quality.
OH2.2	An objective of this Code is to limit the probability that, as a result of the design or construction of a building, a person in the building will be exposed to an unacceptable risk of illness due to ___________ conditions caused by consumption of contaminated water.
OH2.4	An objective of this Code is to limit the probability that, as a result of the design or construction of a building, a person in the building will be exposed to an unacceptable risk of illness due to ____________________ conditions caused by contact with contaminated surfaces.
OP5	An objective of this Code is to limit the probability that, as a result of its design or construction, a building will be exposed to unacceptable risk of ___________ due to leakage of service water or sewage.
OS3.1	An objective of this Code is to limit the probability that, as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of ___________ due to hazards caused by tripping, slipping, falling, contact, drowning or collision.
OS3.4	An objective of this Code is to limit the probability that, as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to ___________ caused by ____.

Functional Statements

There are seven functional statements that are linked to drainage requirements.

F20 To support and withstand expected loads and forces.

F30 To minimize the risk of injury to persons as a result of tripping, slipping, falling, contact, drowning or collision.

F43 To minimize the risk of release of hazardous substances.

F62 To facilitate the dissipation of water and moisture from the building.

F72 To provide facilities for the sanitary disposal of human and domestic wastes.

F80 To resist deterioration resulting from expected service conditions.

F81 To minimize the risk of malfunction, interference, damage, tampering, lack of use or misuse.

Supplementary Standard SA-1 shows the specific functional statements for each requirement.

STOP

ELEMENTS OF THE SANITARY DRAINAGE SYSTEM

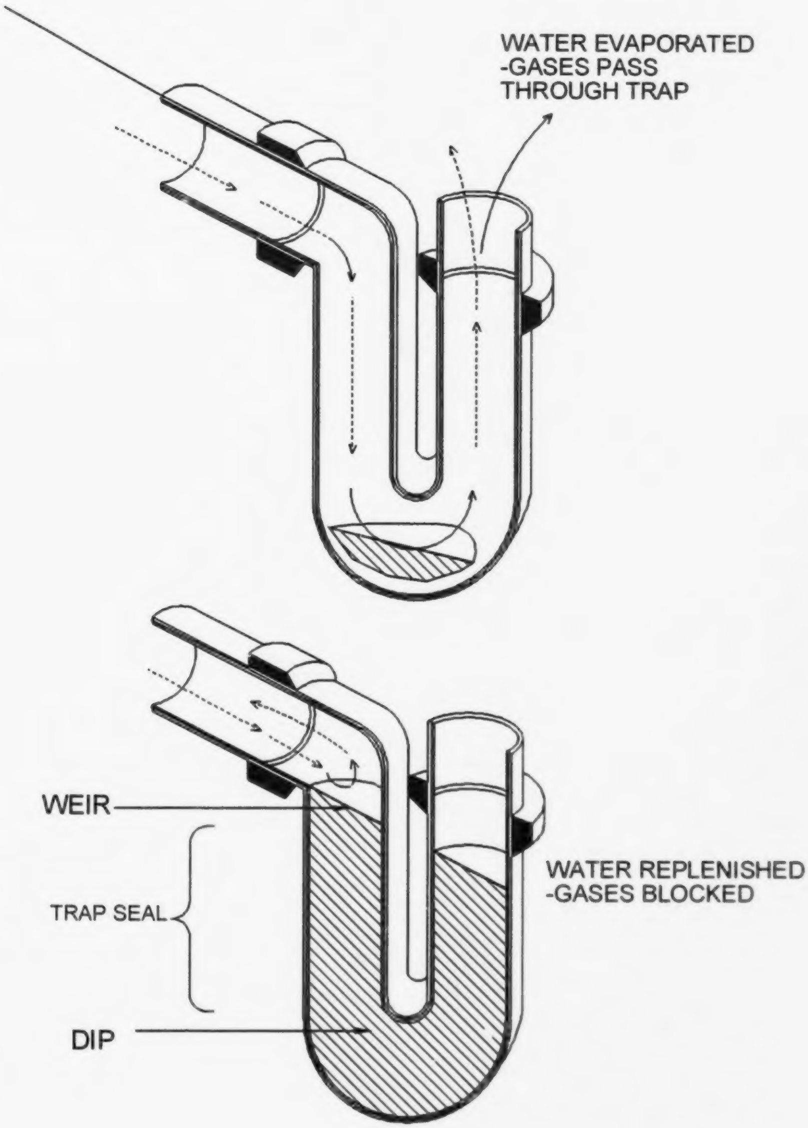
A **fixture drain** is "the pipe that connects a trap serving a fixture to another part of a drainage system."

An important part of the fixture drain is the **trap**. A trap allows the flow of waste water and sewage through a pipe while preventing the passage of air or sewer gases in the reverse direction.

This is achieved through use of a **water seal**. The weight of the water is too great to be displaced by air pressures on the sewer side of the trap. Therefore, no air or gas from the sewer can pass back into the fixture. Figure 6:1 shows how a trap works.

Cleanouts are required to be installed in every drainage system to permit access to the pipes to remove blockages. Cleanouts are located at the base of every stack.

Figure 6:1 THE TRAP



The soil stack and drainage pipe are key components of the sanitary drainage system. A **soil stack** is a vertical soil pipe that passes through one or more storeys. **Soil stacks differ from waste stacks in that they carry discharge from toilets.**

A **drainage pipe** is a non-defined term that means any pipe in a drainage system.

EXERCISE 6-2

Working alone, look at the sanitary drainage system in Figure 6:2 and locate each of the following elements of the sanitary drainage system.

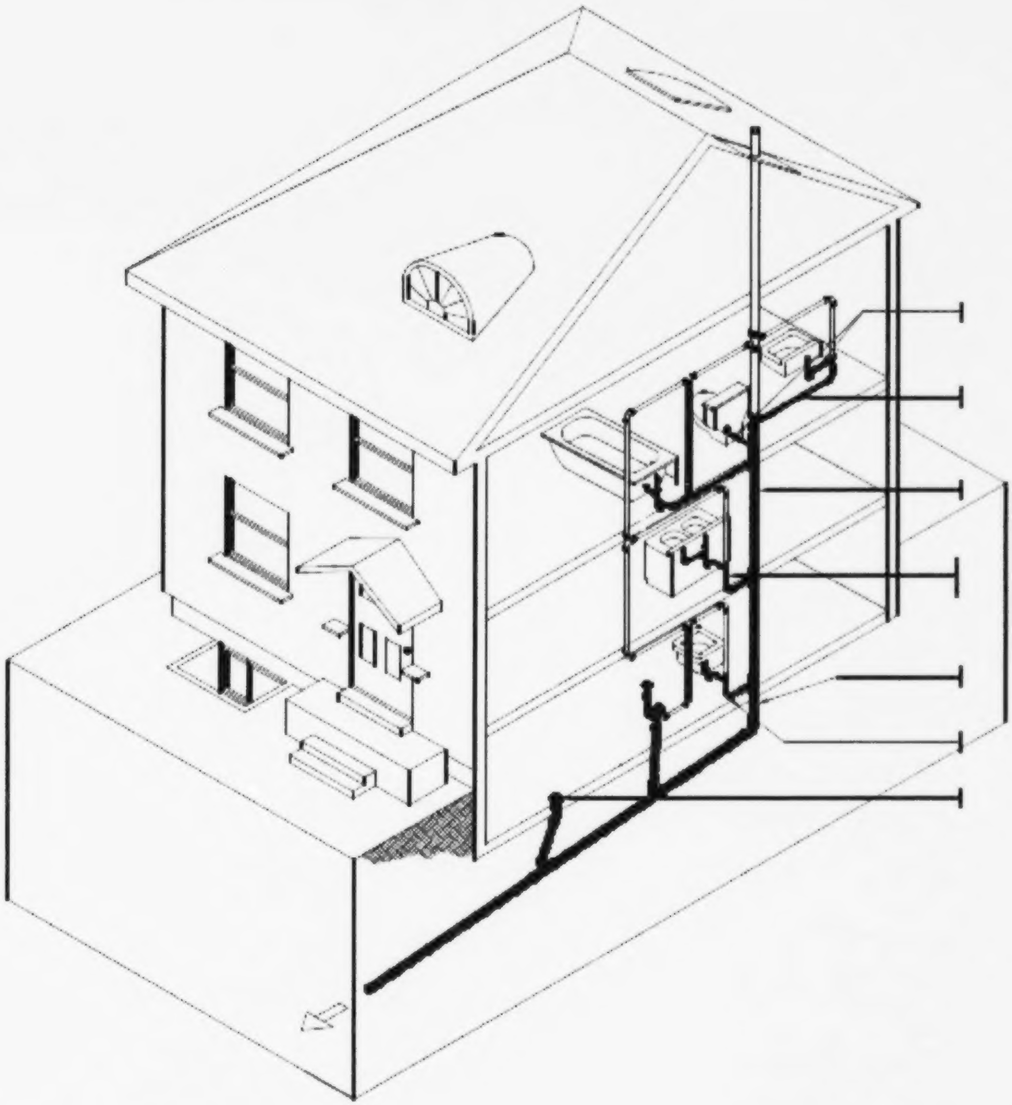
If you are having trouble identifying an element, consult the definitions in Division A of the Code.

Class discussion begins in five minutes.

1. Fixture drains
2. Traps
3. Soil stacks
4. Cleanouts
5. Drainage pipe

STOP

Figure 6:2 Sanitary Drainage System



EXERCISE 6-3

Trap-seal loss is a common problem in drainage systems. In your group, identify two or three reasons for loss of the trap seal. Class discussion begins in five minutes.

EXERCISE 6-4: Sewer Odours in Basement

Your in-laws are here for a visit and they've taken over your bedroom and bathroom. That means you have to use the old bathroom in the basement that nobody's used for months—in fact, not since their last visit! You lean over the basin to brush your teeth and practically faint from a very unpleasant odour. What is this odour and how did it get there? What can you do to eliminate it and prevent it from coming back?

Discuss this in your group and write answers on your flip-chart.

STOP

PARTS OF A SANITARY DRAINAGE SYSTEM

In Drawing M6:3, a number of examples of sanitary drainage piping connect the fixture drains to the stacks. These pipes must have sufficient slope so that they drain properly and do not become clogged. Also, they must be supported so that they don't sag; sagging also leads to blockage of the pipe.

Excessive fall results in solids being left behind while liquids flow too rapidly. Solids that are carried by the water have a tendency to be thrown against the sides of bends above the normal water level and may build up. Insufficient fall results in a sluggish drain, which also gives solids a chance to build up.

Slope, support and cleanouts are dealt with later in this course, using Subsections 7.3.4., 7.4.7. and 7.4.8. as guidelines.

A **floor drain** (Figure 6:3) is a drain that receives water from the floor and conveys it to the drainage system. It is visible as a grate in the floor. The floor drain must have a trap to prevent sewer gas from entering the basement. A floor drain is required in the basement of a dwelling unit where gravity drainage to the building drain is possible as per Sentence 7.1.4.2.(1).

A **horizontal drainage pipe** is the term for a waste pipe that is horizontal and carries discharge from more than one fixture.

A **soil pipe** means a horizontal sanitary drainage pipe that carries the discharge of a toilet or bidet (also called sanitary units), and does not carry discharge from any other fixture.

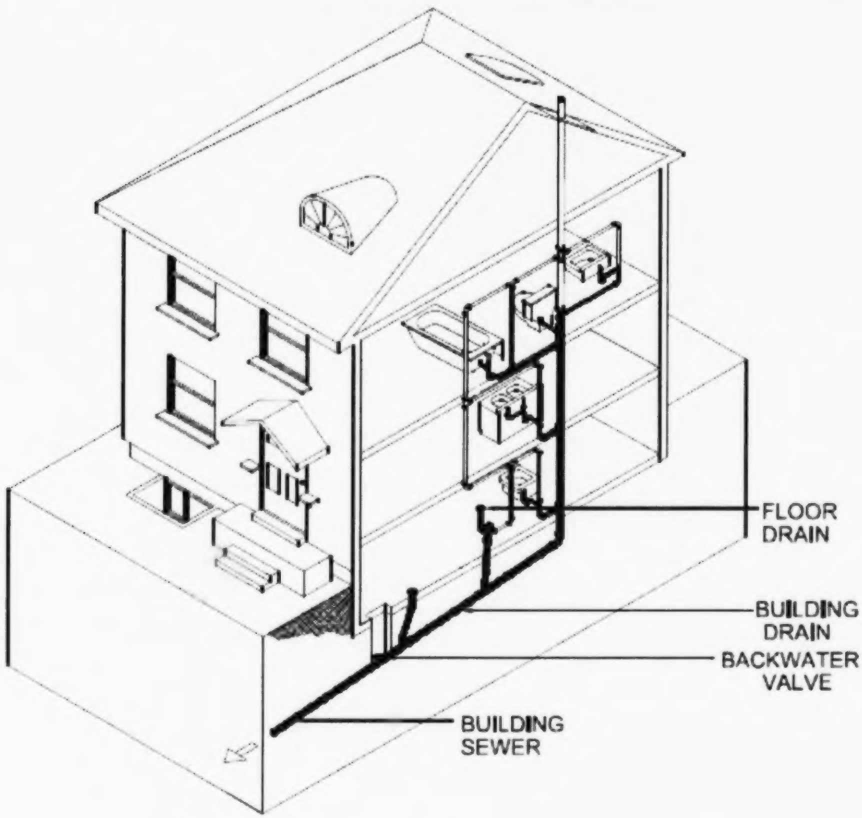
A **backwater valve** may be found in the drainage system. This valve permits sewage water to flow out of the house while preventing any reverse flow. This valve should be accessible from inside the house, in case it needs replacement.

(Unless working in conjunction with the Engineering or Drainage Department, the plumbing inspector should refrain from suggesting the installation of backwater valves.)

Do not confuse backwater valves with backflow preventers.

A cleanout must be downflow of the backwater valve.

Figure 6:3 Parts of a Sanitary Drainage System



Note: A backwater valve is usually only required for specific neighbourhoods as determined by the municipality.

TRAP ARM

Each waste pipe is required to be connected to a trap that serves a fixture. The waste pipe must be installed properly to ensure the waste flows away smoothly, quietly and does not siphon the trap.

The 2006 OBC includes a new term, **trap arm**, which means that portion of a fixture drain between the trap weir and the vent pipe fitting.

Five factors must be considered when inspecting a trap arm:

1) minimum length
2) minimum slope
3) maximum length
4) total fall
5) maximum change in direction

The maximum distance of a trap arm in the 2006 OBC depends on the size of trap served.

The maximum distance of a trap arm is still 1.5 metres for traps up to 2 inches. This ensures that in the case of the smallest size waste pipe (1 ¼ inch), the point at which air is admitted to the waste pipe, when minimum slope is applied, is not lower than the weir level.

Greater distances are permitted for larger traps, and a trap arm can be up to 5 metres for a 6 inch pipe. See Table 7.5.6.3. for all trap sizes.

The reasons for these requirements are described in more detail in Module 10 when we will examine venting.

FIXURE OUTLET PIPES

The fixture outlet pipe is the portion of the drain pipe between a fixture and its trap. As per the definition: the fixture outlet pipe is the pipe that connects the waste opening of a fixture to the trap serving the fixture.

All fixtures must have their fixture outlet pipes sized according to Table 7.4.9.3.

You may want to make a photocopy of this table for quick reference. Exercise 6-5 will give you practice in using this table.

<u>EXERCISE 6-5</u>

Using Table 7.4.9.3., indicate the minimum size of fixture outlet pipe for the following fixtures

	Fixture	Min. Size of Fixture Outlet Pipe (in.)
1	Shower stall	
2	Water closet	
3	Bathtub with shower	
4	Floor drain	
5	Domestic dishwasher	
6	One laundry tub	
7	Domestic sink	
8	Lavatory with a 1¼" trap	

STOP

LOADING

Every fixture has a hydraulic load associated with it. **Hydraulic load** is measure of the volume of fluid that can flow from the fixture at one time.

Hydraulic load is expressed in "**fixture units**" which do not have a specific measurement associated with them. In other words, fixture units do not represent a volume in litres or a flow in litres per second, although fixture units are related to volume and flow.

The hydraulic load of a fixture affects the size of the drain pipes that must be connected to the fixture. **Hydraulic loading is very important in determining the size of stacks and drain pipes.**

Table 7.4.9.3. shows that the size of a fixture outlet pipe and the hydraulic load of the fixture are related. This Table lists the various types of fixtures, and notes their hydraulic loadings.

Table 7.4.9.3. does not include all fixtures, so if a fixture is not listed you must use **Table 7.4.10.2.** to determine the hydraulic load based on the size of the trap serving the fixture. Table 7.4.10.2. applies **only** to fixtures not listed in Table 7.4.9.3.

When **sizing drain pipes**, the hydraulic load is the **total load** from every fixture that is (or may in the future be) connected to the system upstream of a pipe as per Article 7.4.10.1.

Note that Article 7.4.10.3. provides the conversion factors to convert from a flow in litres per second to a hydraulic load in fixture units. Table 7.4.10.3. also converts to fixture units from a semi-continuous flow from specific sizes of traps.

Fixture units do not need to be converted to gallons per minute for sizing of drainage piping in the 2006 OBC. However, **Table 7.4.10.5.** allow you to do this, which might be useful to find to total drainage rate from a building draining to a sewer.

EXERCISE 6-6

Using Table 7.4.9.3. and 7.4.10.2. , indicate the hydraulic load for the following fixtures and groups of fixture served by the same drain pipe.

	Fixture or Group of Fixtures Served by the Same Drain Pipe	Total Hydraulic Load (fixture units)	Code Reference
1	Shower stall		
2	Water closet (tank type)		
3	Kitchen sink		
4	Floor drain with 3 in. trap		
5	Bathroom group (tank type WC)		
6	Kitchen sink and bathroom group		
7	4 lavatories (with 1 ¼ in traps) and 2 tank type water closets		
8	Floor drain with a 4 in. trap		

MINIMUM SIZES OF DRAINAGE PIPES

The size of drainage pipes is determined by the hydraulic load and slope of each pipe. The Code also sets minimum sizes for most pipes.

We will fist look at the minimum sizes of specific drain pipes, then we will look at the sizing for vertical pipes and horizontal pipes.

Study Subsection 7.4.9. The code requirements that establish **minimum pipe sizes** are summarized below:

- No drainage pipe shall drain into another drainage pipe of **lesser size** – 7.4.9.1.(1)
    - The exception is when an engineered waste water heat recovery system is installed – 7.4.9.1.(3)
- The **full size** of a building drain or stack must be maintained where it **penetrates a wall or floor** – 7.4.9.1.(2)
- Every drain pipe (except for a macerating toilet) that serves a **water closet** must be at least 3 in. – 7.4.9.2.(1)
- **Building drains and sewers** must be at least 4 in. – 7.4.9.4.(1)
- Every horizontal drainage pipe that serves **3 or more water closets** must be at least 4 in - 7.4.9.2.(2)
- Every soil stack that serves **more than 6 water closets** shall be at least 4 in. – 7.4.9.2.(3)

SIZING VERTICAL SANITARY DRAINAGE PIPES

Article 7.4.10.6. sets out the requirements for the **maximum hydraulic load for a vertical waste pipe, branch or stack.**

The general rule is that **Table 7.4.10.6.A is used to size soil or waste stacks**. You will need to verify the maximum hydraulic load carried by the stack, AND the maximum fixture units drained from any one storey.

No vertical waste pipe, branch or stack of **less than 3"** may have a hydraulic load of more than that permitted by **Table 7.4.10.6.B.**—Sentence 7.4.10.6.(4).

These tables are partially based on the requirement that a vertical sanitary drainage pipe shall be designed to carry no more than 29% of its full capacity—Sentence 7.4.10.6.(3).

The facilitator will shortly have you complete an exercise based on the material in these Tables. Take a few minutes to familiarize yourself with this information before you go on.

<u>EXERCISE 6-7</u>

Size the following **vertical sanitary drainage pipes** using the appropriate tables from Section 7.4.9. and 7.4.10. and the minimum pipe size requirements.

	Fixtures Served by the Vertical Drainage Pipe	Hydraulic Load (Fixture units)	Minimum Size of Vertical Pipe (in)	Code Reference
1	2 lavatories (1¼ in. traps) in a 2 storey house			
2	2 lavatories (1¼ in. traps) and 2 bathtubs in a 2 storey house			
3	Flush tank WC			
4	3 bathroom groups total, one per storey (flush tank WCs)			
5	7 water closets (flush tank)			
6	12 fixture units from each storey in a 3 storey building			

STOP

Have the class read to the STOP and complete the sizing exercise for horizontal pipes.

*Budget **20 minutes.***

SIZING HORIZONTAL SANITARY DRAINAGE PIPES

Articles 7.4.10.7. and 7.4.10.8. set out the requirements for the maximum hydraulic load for horizontal branches and for horizontal sanitary drainage pipes.

For horizontal branches less than 2 inches, you will only need to know the maximum hydraulic load carried by the branch. You can see in Table 7.4.10.7. that these small pipes cannot serve many fixtures.

For horizontal sanitary drainage pipes you will need to know the maximum hydraulic load carried by the pipe AND the slope of the pipe. Table 7.4.10.8. shows the maximum hydraulic loading for sanitary horizontal drains.

Sentence 7.4.10.8.(2) states that a horizontal sanitary-drainage pipe shall be designed to carry no more than 65% of its full capacity.

EXERCISE 6-8

Size the following **horizontal sanitary drainage pipes** using the appropriate tables from Section 7.4.9. and 7.4.10. and the minimum pipe size requirements.

	Fixtures Served by the Horizontal Drainage Pipe	Hydraulic Load (Fixture units)	Minimum Size of Horizontal Pipe (in)	Code Reference
1	2 lavatories (1 ¼ in. traps)			
2	One water closet (flush tank)			
3	4 water closets (flush tank)			
4	Two bathroom groups (flush tank)			
5	Building drain with 30 fixture units			

PROCEDURE TO SIZE DRAINAGE PIPES

To determine the size of drainage pipes, follow these steps.

Determine:

1. The **hydraulic load** (in fixture units) for each fixture in the system using Table 7.4.9.3. or Table 7.4.10.2.
2. The **cumulative hydraulic load** (in fixture units) for each pipe section.
3. The **pipe size for the soil or waste stack** using Table 7.4.10.6.A.
4. The pipe size for the **horizontal sanitary drainage pipes**. Use Table 7.4.10.7. for pipes less than 2 in., and use Table 7.4.10.8. for pipes 3 in. and larger.

Steps 3 and 4 may be reversed depending on the piping layout.

EXERCISE 6-9: Sizing Exercise

Use Subsection 7.4.9 and the appropriate sizing tables in Subsection 7.4.10. to size the vertical and horizontal drainage pipes in the figure below. The figure shows 5 vertical drain pipes connecting to a horizontal sanitary drainage pipe. (Note that the fittings are schematic only.)

Work with your group. When completed, put answers on your flipchart.

Figure 6:4 Sizing Exercise

Notes:
All water closets are direct flush (flush valve)
The slope of the pipes is 1:50

Notes/calculations (Exercise 6-9):

STOP

STORM DRAINAGE

The other drainage system to examine is storm drainage. Storm drains and sewers are intended to collect water from storm drainage piping and subsoil drainage pipes and to move it away from the house.

Storm sewage means water that is discharged from a surface as a result of rainfall, snowmelt or snowfall. Storm sewage is collected from the roof through either a downpipe (outside the building) or a rainwater leader (inside the building) and conducted to the **storm building drain**. The downpipe is NOT considered to be part of the plumbing system.

The storm building drain connects to the **storm building**

sewer at a point 1 m outside the house.

The storm building sewer connects to the municipal storm-drainage system, if there is one. In areas where there is no municipal storm-drainage system, the storm sewage may drain to a ditch or other place of disposal.

In some municipalities, the storm building drain is found under the house. In other municipalities the storm building drain is laid around the outside of the foundation for easier access.

Foundation drains (also called weeping tile) may also be connected to the storm building drain to channel water away from the foundation of the house. This occurs at the discretion of the municipality or region through a sewer use by-law.

The 2006 OBC has new requirements for the size of storm drainage pipe sizing, which will be examined in the next module. The minimum size for the storm building sewers or **storm building drains** that make up the storm drainage system shall be at least 4 inches (10 cm), according to Sentence 7.4.9.4.(2) of the Code.

A **sump** may also be included in the storm drainage system. A sump is a water-tight tank or pit, open to the atmosphere, which receives storm water or other liquid waste that does not require treatment (sanitary sewage).

In practice, the sump is usually covered, both for safety reasons and to prevent it acting as a floor drain. The water is pumped from the sump to a storm sewer or other point of disposal.

Wherever a sump or tank receives sanitary sewage, it is required to be water-tight, air-tight and vented. The discharge pipe from a pump or ejector serving such tanks must be equipped with:

1 - a union,
2 - a check valve, and
3 - a shut-off valve,

installed in that sequence in the direction of discharge.

STOP

EXERCISE 6-10

In your group, identify situations where you would expect to find a sump. Class discussion begins in five minutes

COMBINED SEWERS

Some municipalities in the past have allowed both the sanitary and storm drainage systems to connect to a public combined sewage system. This is called a combined sewer.

References to combined sewers are found in Article 7.1.5.1. of the Ontario Building Code. Combined building drains and combined building sewers are not permitted by the OBC.

EXERCISE 6-11

Why do you think combined sewers are no longer allowed? List problems that are associated with combined sewers. Class discussion begins in five minutes.

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–
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–
–

STOP

Gasoline spill in sewer destroys Timmins homes

BY YVES LAVIGNE

Two houses were destroyed and 19 others damaged in fires after a railway tank car leaked thousands of litres of gasoline into storm sewers in Timmins, Ont., yesterday.

A boy was blown out of his home when a spark ignited gasoline fumes that seeped into the basement, and fireman was cut by flying glass.

James Allarie and his family fled their exploding two-story house minutes before it crumbled in flames. "We got out with just the clothes on our back," he said.

A fire department spokesman said 4000 to 5000 people were told to leave their homes in the south end of the Northern Ontario city of 45,000. Most were billeted with relatives and friends. Hydro and natural gas service to another 7000 residents was cut, but they were allowed to stay at home.

Nearly 100 city blocks in residential and commercial areas were affected. Police patrolled the area last night, on the lookout for looting.

More than 200 full-time and volunteer firemen fought the fires, which started shortly after the 9 a.m. spill.

About 1000 litres of the 5000-litre spill drained into the sewers, Fire Chief Albert Schaffer said.

Fumes seeping into basements through drainage pipes were ignited by furnace pilot lights and cigarettes, causing explosions along several streets as the gasoline flowed through the sewer system.

A large section of Timmins, a mining centre about 700 kilometres north of Toronto, was blacked out at 10:23 a.m., when fire officials ordered electricity turned off to prevent sparks that would ignite the fumes.

SUMMARY

The general principle of the drainage system is to conduct sanitary wastes and stormwater from the house to the municipal collection system. The code requirements for drainage are meant to address health, safety and property protection as shown in the objectives linked to the requirements.

MODULE 6 QUIZ

1. A fixture drain connects:
   a) A waste opening to a trap
   b) A trap to another part of a drainage system
   c) Both sanitary and nonsanitary units
   d) A building drain to a building sewer

   Code Ref: ________________

2. The building drain connects to the building sewer:
   a) At the foot of the soil stack
   b) Under the house
   c) At the lot line
   d) One metre outside the house

   Code Ref: ________________

3. A foundation drain may also be known as:
   a) Foundation pipe
   b) Weeping tile
   c) Located under a building
   d) Part of a drainage system

4. A sanitary sump which receives sewage must be:
   a) Air tight and water tight
   b) Vented
   c) Air tight only
   d) Air tight, water tight and vented

   Code Ref: ________________

5. When operating properly, the trap should be:
   a) Full of water
   b) Empty
   c) Full of sewer gas
   d) Full of waste

6. A drainage pipe is NOT permitted to be:
   a) Less than 1 ½ in.
   b) Greater than 15 in.
   c) Connected to a drainage pipe of lesser size
   d) Connected to a drainage pipe of greater size

   Code Ref: ________________

7. If a fixture is NOT listed in Table 7.4.9.3., the fixture should be sized based on:
   a) A similar fixture in Table 7.4.9.3.
   b) An estimated hydraulic load
   c) The size of the drain pipe and Table 7.4.10.2.
   d) The size of the trap and Table 7.4.10.2.

   Code Ref: ________________

8. The total fall of a trap arm is required to be:
   a) 1.5 metres
   b) Not less than the inside diameter of the fixture drain
   c) Not greater than the inside diameter of the fixture drain
   d) Equal to the size of the fixture drain

   Code Ref: ________________

9. When operating properly, the trap should be:
   a) Full of water
   b) Empty
   c) Full of sewer gas
   d) Full of waste

   Code Ref: ________________

END OF MODULE 6

MODULE 7

SEWER AND DRAIN INSPECTION I

PLUMBING - HOUSE - 2007

MODULE CONTENTS

In this module, you will start looking at specific inspections by beginning with the inspection of sewers and drains.

LEARNING OBJECTIVES

Upon completion of this module, participants will be able to:

- Plan and carry out an inspection of the building sewer, building drain, and storm drainage piping
- Define terms that are related to this phase of inspection
- Identify some of the problems you are likely to encounter on this inspection
- Determine compliance with the Ontario Building Code as it relates to building sewers and drains
- Calculate fixture units and size drains

INTRODUCTION TO INSPECTIONS

For the next three modules, you will be looking at inspections in detail. You will be using a checklist to guide you through the inspections and to ensure that no important steps are missed.

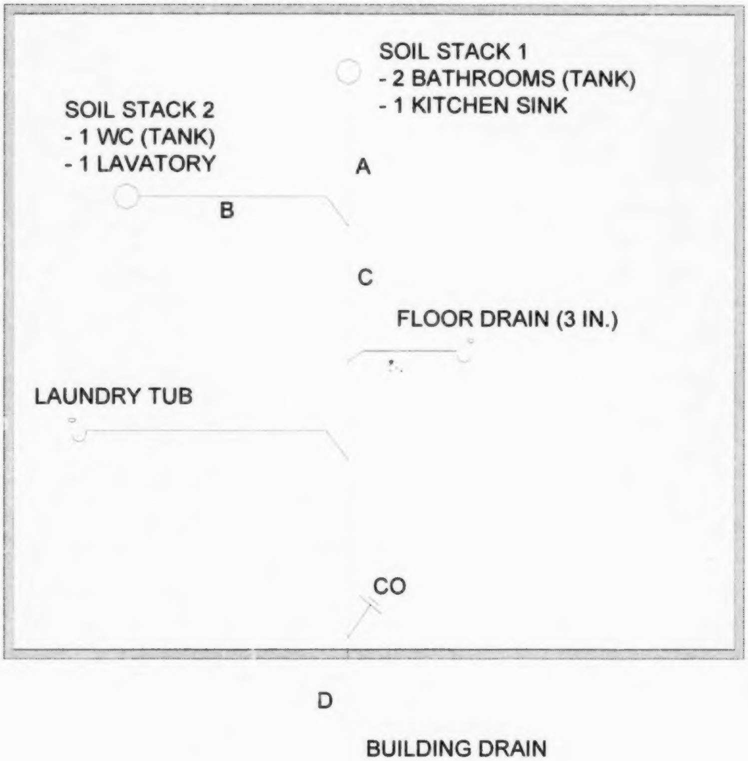
This first inspection covers building sewers and building drains. Although some inspections may be combined, for the sake of clarity we will concentrate on one inspection at a time. First, however, let's review pipe-sizing with a short exercise.

EXERCISE 7-1

Working alone, calculate the horizontal pipe sizes required according to Figure 7:1. Use Subsection 7.4.9 and 7.4.10. to size the horizontal drainage pipes.

Compare your answers with your group. Class discussion begins in five minutes.

Figure 7:1 SIZING HORIZONTAL DRAIN PIPES



Exercise 7-1 continued

	Fixture Units	Pipe Size (in.)	Code Reference
Soil Stack 1		-	
Soil Stack 2		-	
Laundry Tub		-	
Floor Drain		-	
Point A			
Point B			
Point C			
Point D			

STOP

Think back to the plumbing model described in Module Six. Two types of drainage systems were covered in the model:

- Sanitary drainage, which removes liquid waste that may contain matter in suspension
- Storm drainage, which removes storm water and rain water, melted snow, water in the subsoil, and so on

Both of these systems are covered in the first inspection.

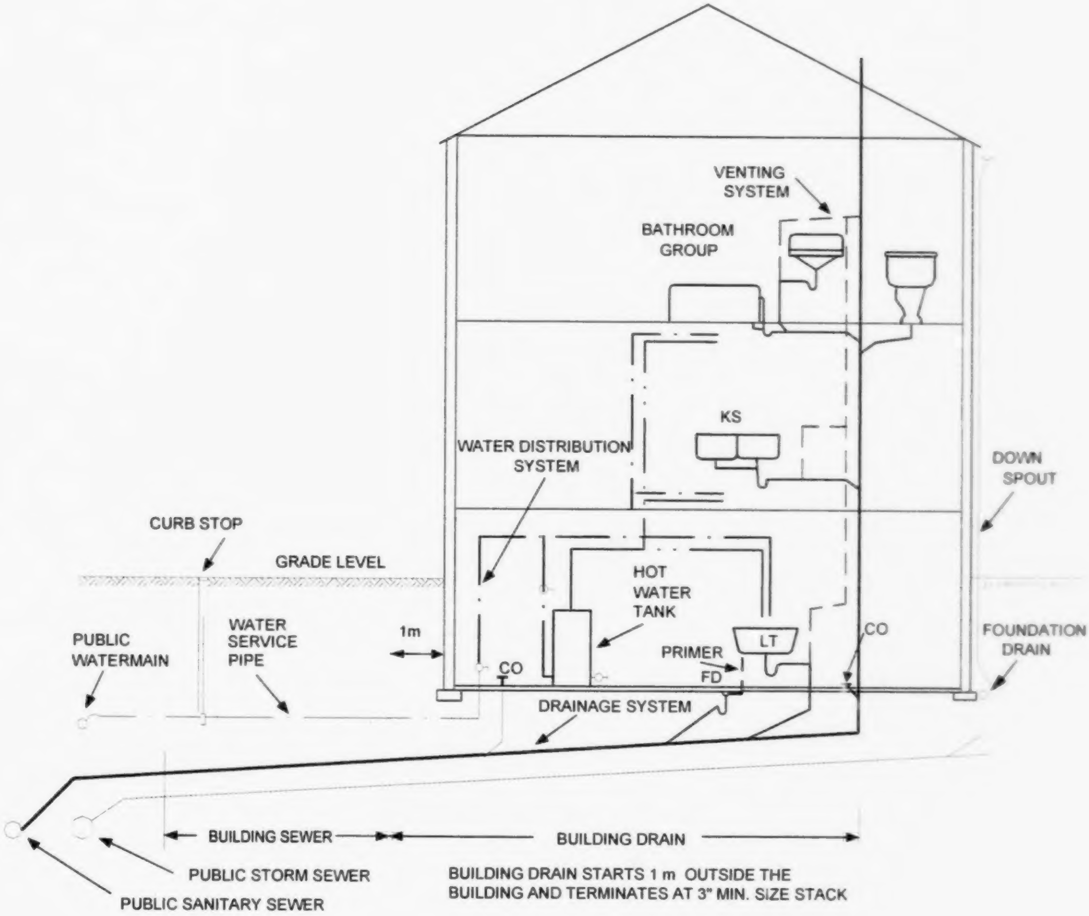
EXERCISE 7-2

Drawing 7:2 shows the drainage system in the plumbing model. On it, identify:

1. The building sewer
2. The building drain

Work by yourself. Class discussion begins in five minutes.

Figure 7:2 DRAINAGE SYSTEM



Note: Water supply piping is not completely shown for clarity.

STOP

PREPARATION FOR THE INSPECTION

This is your first inspection. How are you going to prepare for it?

Getting yourself organized before heading out to the site is very important. There are two main things to consider:

- What you need to think about to prepare yourself for the inspection
- What you need to take with you on this inspection

<u>EXERCISE 7-3</u>

In your group, put together a list for each of these two areas of preparation. You may use the chart below.

What to think about	What to take along

PLANS REVIEW

If plans for the building have been submitted along with the permit application, it's a good idea to review them before you go out to the site.

EXERCISE 7-4

Remember that you are inspecting sanitary and storm sewers and drains. What should you look for in the plans that will be useful information for conducting your inspection? Take a couple of minutes to discuss this in your group.

Notes (Exercise 7-4)

It is unlikely that building plans will be filed for a single-family dwelling such as the MITEC house.

It is more common for some municipalities to ask that drain plans be filed along with the permit application. These plans can be very useful, as they give you some idea of what to expect when you get to the site.

EXERCISE 7-5

The drain plan is shown in Figure 7:3. Working by yourself, answer the following questions. Class discussion begins in five minutes.

In each plan, drainage pipes have been identified as follows:

a) The storm building drain
b) The storm building sewer
c) The sanitary building drain
d) The sanitary building sewer

1. What is the difference between the two sewer systems shown?

____

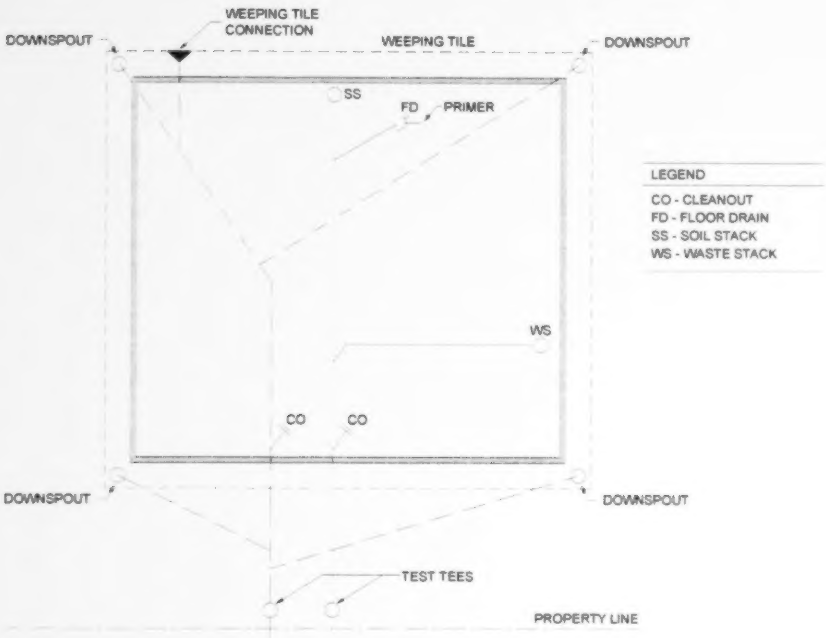
____

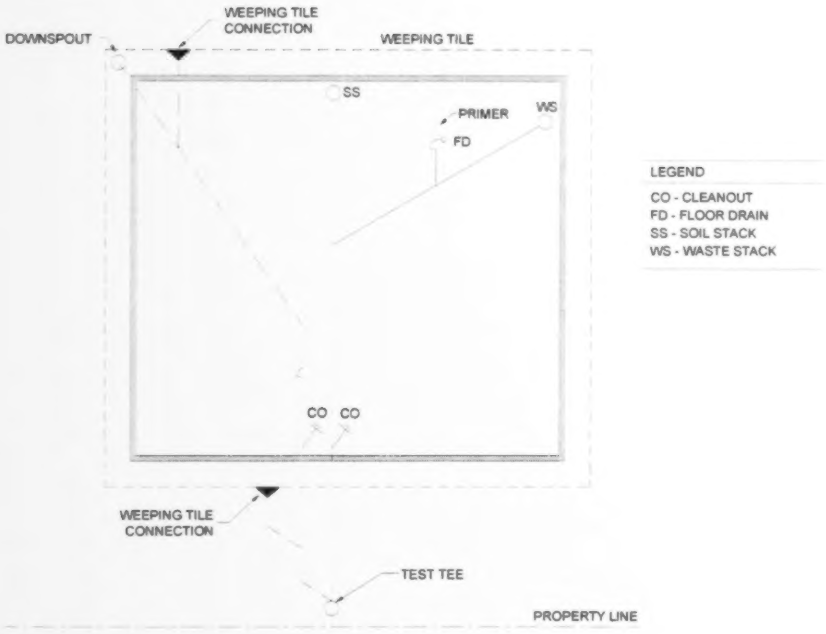
2. Are there any deficiencies in Figure 7:3?

____

____

Figure 7:3 DRAIN LAYOUTS





3. Are both types allowed in your municipality?

____

____

STOP

EXERCISE 7-6

Why would it be useful to have the drain plan on record in the municipality? Discuss this in your group and record your ideas on the flipchart.

Notes:

STOP

DEFINITIONS

A number of terms related to this inspection are defined in Division A Part 1 of the Ontario Building Code. Make sure you understand each of these words before you deal with contractors and the public. You may be called upon to explain what they mean to someone who is not familiar with the Code.

EXERCISE 7-7

Identify the differences between the paired terms.

1. Building drain; building sewer

____

____

2. Storm building drain; storm building sewer

____

____

3. Rainwater leader; downspout

____

____

4. Fixture unit; sanitary unit

____

____

5. Floor drain; foundation drain

EXERCISE 7-8: Definitions

The following words are also related to the inspection of sewers and drains. Working alone, look them up in Division A, Part 1 in the Code and read the definition. (The space allotted is for your own notes, if you feel you need to make any.)

1. Backwater valve

2. Sanitary drainage piping

3. Drainage system

4. Force main

5. Private sewer

6. Sanitary sewage

7. Storm drainage piping

____

____

8. Storm sewage

____

____

STOP

SITE CONDITIONS

On this first inspection, the site will not be very developed. The footings for the building will have been poured and the weeping tiles laid—but that's about it.

Think of what you are here to inspect—sewers and drains. The building sewer and building drain will be laid at this point. It is likely that the building drain will end just inside the foundation at a cleanout.

The rest of the building drain will be installed later, when the plumber or drain contractor knows the location of the stacks. The building drain can then be laid so that it will connect properly to the stacks.

EXERCISE 7-9

Discuss the following questions in your group. Class discussion begins in five minutes.

1. What parts of the site will you be interested in seeing?

____

____

____

2. How are you going to get close to the pipes?

____

____

____

STOP

ACCESS TO PIPES

You should be able to see all the pipes and connections in order to inspect them. What should you do if the pipes are covered? This situation is covered in the Building Code Act.

EXERCISE 7-10

What should you do if the pipes are covered when you come to inspect? Look up what the Building Code Act has to say. Discuss it in your group. Class discussion begins in five minutes.

Notes:

Code Ref:

STOP

MATERIALS

Many kinds of materials may be used in a plumbing system. Some of these materials are acceptable for use in underground sewers and drains, and others are not.

EXERCISE 7-11

Fill in the chart below for permitted pipe only. Refer to Subsections 7.2.5. Non-metallic Pipe and Fittings, 7.2.6. Ferrous Pipe and Fittings and 7.2.7. Non-Ferrous Pipe and Fittings in the Code.

Review the acceptable materials for underground drains and sewers in the first column, and indicate with a "yes" or a "no" if they can be used. Include the relevant code reference and CSA number. Work alone. Class discussion begins in 15 minutes.

Underground Drain and Sewer Pipe Materials
Reference Subsections 7.2.5., 7.2.6., and 7.2.7.

Materials	Building Drain	Building Sewer	Cond-itions	Code Reference	Standard
Asbestos-Cement					
Concrete					
Vitrified Clay					
Polyethylene					
ABS					
PVC					
Cast Iron					
Galvanized Steel					
Corrugated Steel					
Copper					
Brass					
Copper Tube – Type K & L hard					
Lead					

Note 1 – Underground Rehab only
Note 2 – Above Ground use only
Note 3 – Storm Drainage only

STOP

SIZING OF DRAINANGE PIPES

You have already practiced sizing drainage pipes.Subsection 7.4.9. of the Ontario Building Code regulates the size of drainage piping.

EXERCISE 7-12

1. According to the Code, what minimum size should the following pipes be? Remember that this is the inside diameter of the pipe.

   a) Building drain

   ____

   Code Ref: ______________

   b) Building sewer

   ____

   Code Ref: ______________

2. What is the minimum size of drainage piping specified in the Code?

   a) Serving one water closet

   ____

   Code Ref: ______________

   b) Downstream of the third water closet

   ____

   Code Ref: ______________

STOP

LOADING

Subsection 7.4.10. of the Ontario Building Code deals with hydraulic loads—the maximum amount of water or waste flowing through a pipe at one time. This is related to the number of fixtures that will drain into the system.

EXERCISE 7-13

Referring to Table 7.4.9.3. and the floor plans of the MITEC house in Module One, determine the total hydraulic load, in fixture units, for the MITEC house plumbing system. Work by yourself; class discussion begins in five minutes.

Hydraulic Load for Typical Fixtures in a House

Reference Table 7.4.9.3. for the Minimum Permitted Size of Fixture Outlet Pipe and Hydraulic Loads for Fixtures

	Fixtures	Fixture Units
1.	WC with Flush Tank	
2.	Lavatory	
3.	Kitchen sink	
4.	Laundry tub	
5.	Two bathroom groups with Flush tanks	
6.	2 inch floor drain	
7.	Total	

STOP

EXERCISE 7-14

Answer the following questions, then compare your answers to those of the other members of your group. Class discussion begins in 10 minutes.

1. Using only Table 7.4.10.8, what is the smallest size of a building drain?

____

2. Can this pipe size be used for the horizontal building drain? Why or Why not ?

____

____

Code Ref:______________________________________

3. Use Table 7.4.10.5. to calculate the maximum probable drainage rate of the MITEC house plumbing system.

____

____

STOP

SLOPE AND LENGTH

Drainage piping must have some slope (see Figure 7:4), or the waste will not drain out of the system without the aid of a pump. Subsection 7.4.8. of the Code deals with minimum slope and size of drainage pipes. However, these regulations apply to drainage pipe of 3" size or less.

EXERCISE 7-15

The minimum size of the building drain is 4". To determine the required slope for this size of pipe, turn again to Table 7.4.10.8.

Answer the following questions on your own, then discuss your answers with your group. Class discussion begins in five minutes.

1. What should be the slope of the MITEC house building drain, based on the number of fixture units in the system?

____

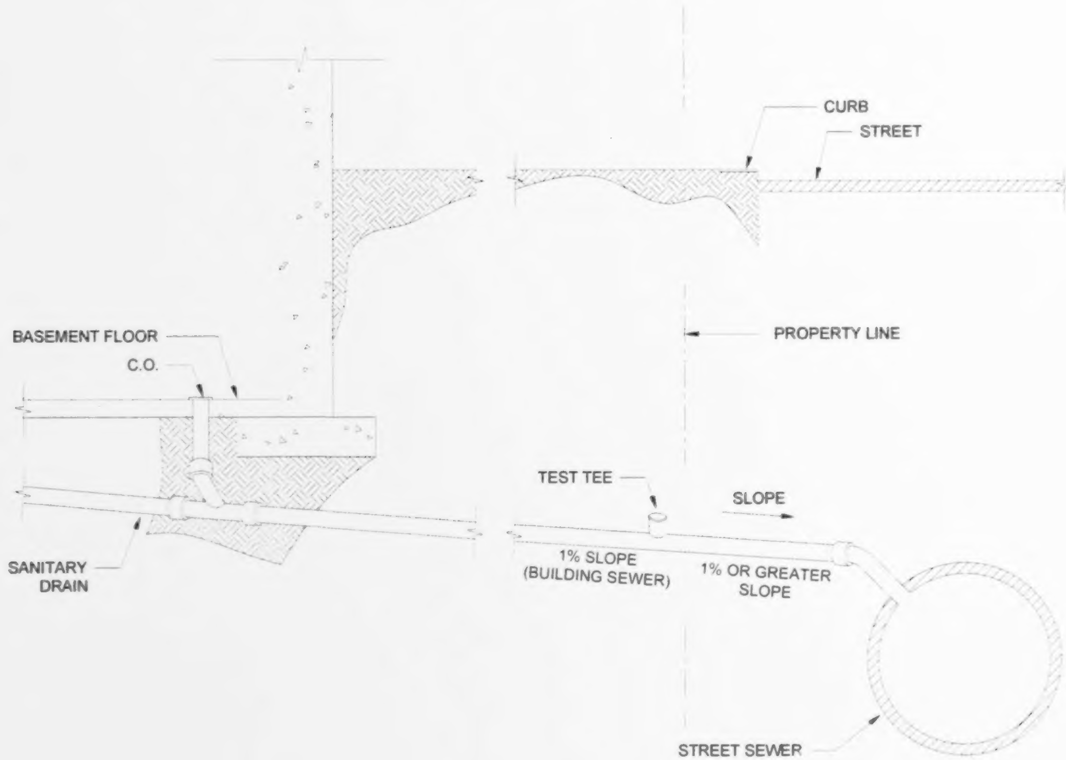
2. Once you are on the building site, how will you establish the slope of the building drain and building sewer?

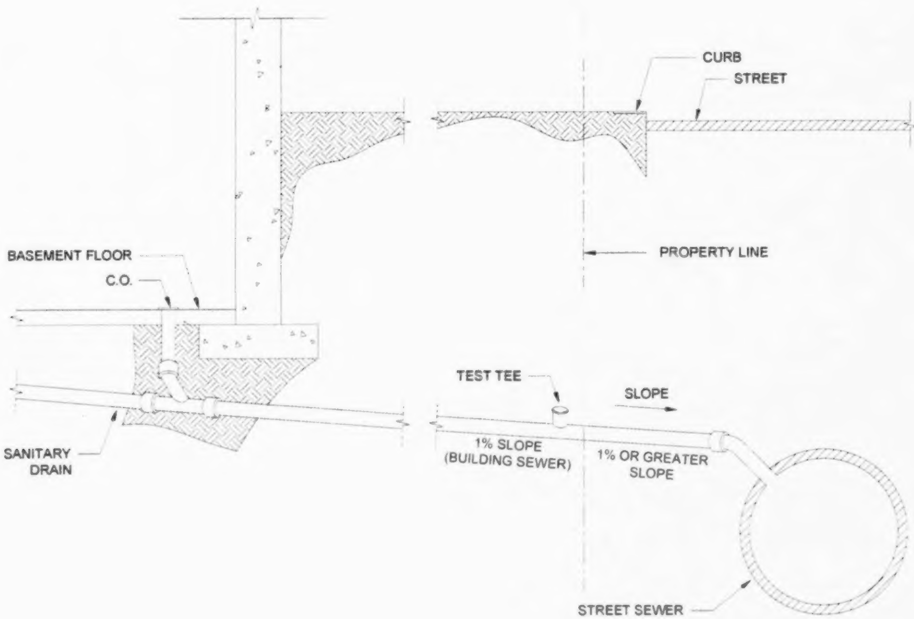
____

____

STOP

Figure 7:4 SANITARY BUILDING DRAIN




CURB
STREET
BASEMENT FLOOR
C.O.
PROPERTY LINE
TEST TEE
SLOPE
SANITARY DRAIN
1% SLOPE (BUILDING SEWER)
1% OR GREATER SLOPE
STREET SEWER

MODULE 7 QUIZ

1. What material is permissible for use in a building sewer:

   a) Polyethylene pipe
   b) CPVC pipe
   c) Concrete pipe
   d) Polybutylene pipe
   Code Ref: ________________

2. What is the minimum acceptable size for the building drain in the MITEC house?

   a) 2"
   b) 3"
   c) 4"
   d) 5"
   Code Ref: ________________

3. What is the minimum slope required for the building drain in the MITEC house?

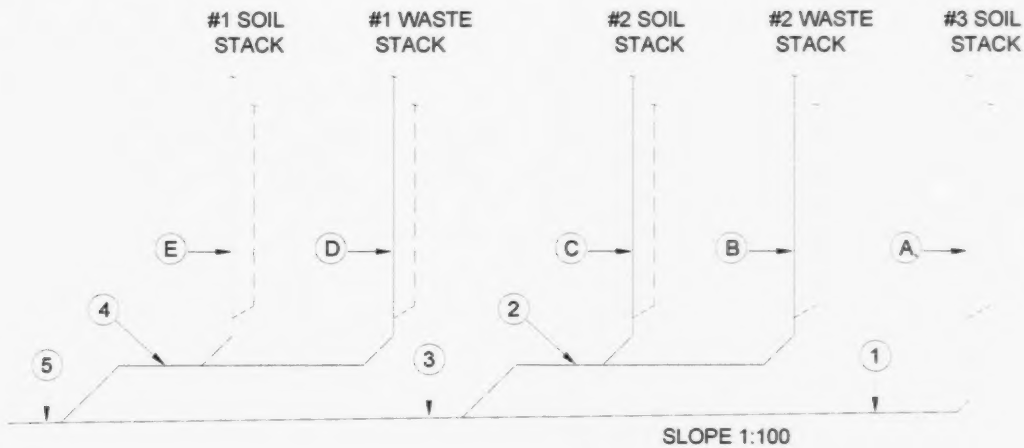
   a) 1:25
   b) 1:50
   c) 1:100
   d) 1:200
   Code Ref: ________________

4. According to Article 7.3.4.6. of the Code, nominally horizontal piping that is underground:

   a) Shall be supported on a base that is firm and continuous under the whole pipe
   b) May be installed using hangers fixed to a foundation
   c) May be installed using hangers fixed to a structural slab
   d) All of the above

5. Size the drain pipes in Figure 7:5 for a small 4 storey residential building. All toilets are the tank type. The horizontal drain on the bottom is the building drain. There are a maximum of 2 water closets per floor on any one stack.
This is much larger than a house, but it will test your knowledge of drain pipe sizing.

Figure 7:5 Quiz Drain Sizing



Stack No.	Fixtures	F.U.s	Total F.U.s
Soil Stack 1	6 - bathroom groups		
	6 - kitchen sinks		
Waste Stack 1	6 – 3 in. floor drains		
	6 – 1 ½ in auto washers		
Soil Stack 2	3 – bathroom groups		
	3 – kitchen sinks		
Waste Stack 2	3 – 2 in. floor drains		
	3 – 1 ½ in. auto washers		
Soil Stack 3	2 – bathroom groups		
	2 – kitchen sinks		
	2 – 2 in. floor drains		
	2 – 1 ½ auto washers		

Location	Fixture Units/Sizing Considerations	Pipe Size
A		
B		
C		
D		
E		
1		
2		
3		
4		
5		

END OF MODULE 7

MODULE 8

SEWER AND DRAIN INSPECTION II

PLUMBING - HOUSE - 2007

MODULE CONTENTS

LEARNING OBJECTIVES

Upon completion of this module, participants will be able to:

- Plan and carry out an inspection of the building sewer, building drain, and storm drainage piping
- Define terms that are related to this phase of inspection
- Identify some of the problems you are likely to encounter on this inspection
- Determine compliance with the Ontario Building Code as it relates to building sewers and drains

CONNECTIONS

The most important connections in this first inspection are those between the building sewer and the municipal or private sewage system, and those between the storm building sewer and the municipal storm-drainage system.

Both building sewer systems connect to the municipal sewer systems at a test tee located at the property line. Drawing M8:1 shows what the test tee connection looks like. As you can see, it may be difficult to tell which is the sanitary and which is the storm sewer.

EXERCISE 8-1

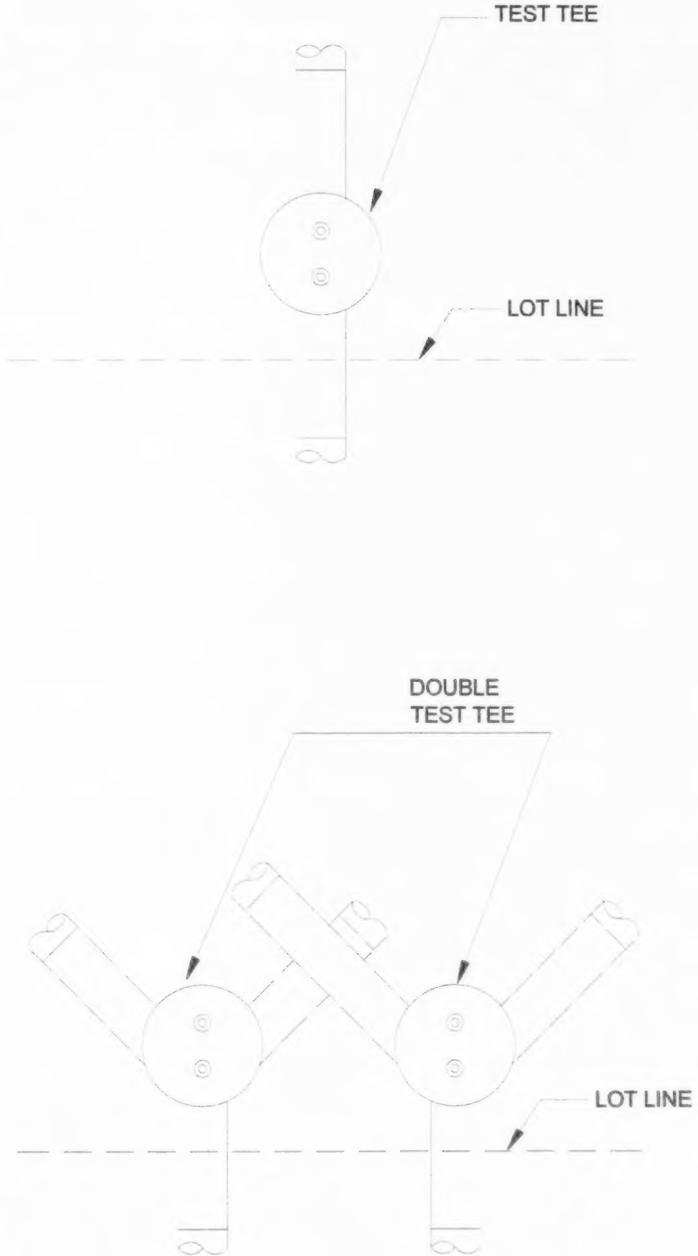
In some municipalities where plastic pipe is used for sewers, the storm and sanitary sewers are pipes of different colours. Discuss the following questions in your group. Share your experiences with the class in about five minutes.

1. What do you do in your municipality?

____

____

Figure 8:1 TEST TEE AND DOUBLE TEST TEE (Plan View)



2. What other ways could you use to tell the two pipes apart?

____

____

STOP

PROTECTION OF UNDERGROUND PIPES

Section 7.3.5. describes the protection required for piping. The protection is from various types of damage that could occur to pipes if installed improperly.

Backfill is required to be free of stones and boulders, and is to be carefully placed and tamped to a height of 300 mm over the top of the pipe – Article 7.3.5.1.

Figure 8:2 illustrates the protection required for non-metallic pipe such as asbestos-cement or vitrified clay – Article 7.3.5.2.

Piping is required to be protected from loads from a wall above, from frost, from mechanical damage and from condensation.

EXERCISE 8-2

1. Find some of the most common objectives and functional statements that are linked to the requirements in Subsection 7.3.5. Briefly state the reasons for the requirements for the protection of piping using key words from the objectives and functional statements. Discuss this with your group.

____

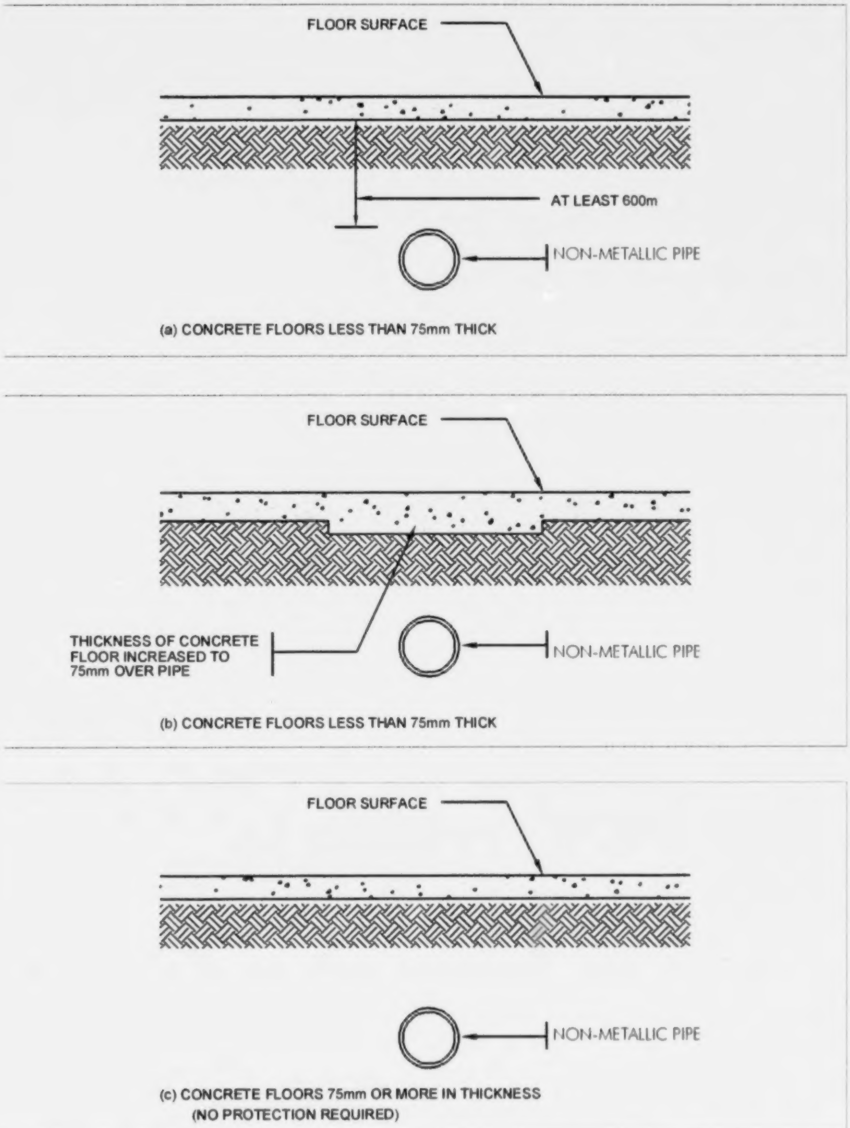
____

____

____

STOP

Figure 8:2 PROTECTION OF UNDERGROUND NONMETALLIC PIPES



(a) CONCRETE FLOORS LESS THAN 75mm THICK

(b) CONCRETE FLOORS LESS THAN 75mm THICK

(c) CONCRETE FLOORS 75mm OR MORE IN THICKNESS (NO PROTECTION REQUIRED)

PIPE SUPPORT

As you can imagine, it is very important that drainage and sewer pipes be supported so that they don't bend and clog, crack, or break. The Code states clearly that pipes must be properly supported. Figure 8:3 shows support for a sewer pipe in the trench.

The type of supporting material used depends on the type of pipe being supported. With plastic pipe in general, 100 mm to 150 mm of noncohesive material, with a grain size no larger than one-half inch (½" or 1.25 cm), lines the bottom of the trench. The pipe is laid on this supporting layer and the material adjusted so that there are no gaps under the pipe (Article 7.3.4.6.).

Once the pipe has been inspected, another layer of the same material will cover the pipe up to 300 mm before the rest of the trench is filled (Article 7.3.5.1.).

<u>EXERCISE 8-3</u>

1.What is noncohesive material?

____

____

Code Ref:________________________________

2.What type of bedding is used in your municipality?

____

____

Code Ref:________________________________

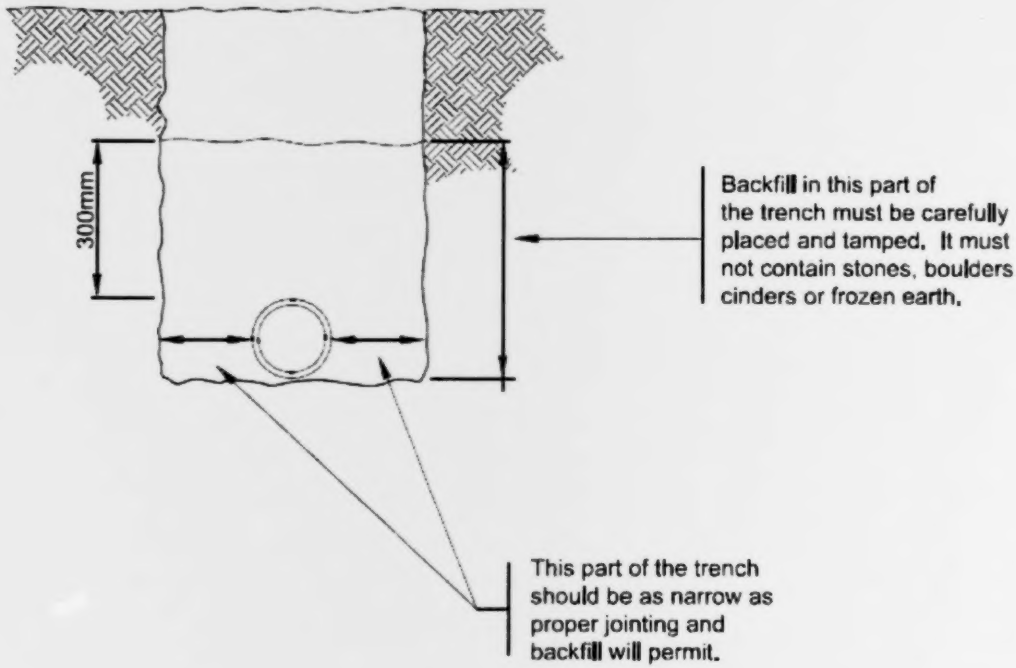
3.What type of support does the Code specify for drainage and sewer piping made of other materials?

____

____

Code Ref:________________________________

Figure 8:3 SUPPORT FOR PLASTIC PIPE: BACKFILLING OF PIPE TRENCH



4. Once you are on the building site, how can you tell if the pipe is adequately supported?

____

____

5. In most cases the building drain will be laid under the footings and below the basement floor of the house. In some situations the piping may have to go through the wall of the basement. What does the Code say about support in this case?

____

____

Code Ref:________________________________

STOP

TESTING THE DRAINAGE SYSTEM

Once you have looked at the layout of the pipes and the connection to the municipal services, you are required to witness a test of the installation, performed by the contractor, to ensure that sewage and storm water will drain from the system and that there are no leaks. Subsection 7.3.6. of the Code mentions a water test, air test, final test and ball test that could be performed on drainage and venting systems.

A standard test carried out on sewers and drains is the ball test. A billiard ball is dropped into the building drain at the house and retrieved at the test tee on the property line—if it does not get stuck along the way!

This test ensures that there is sufficient slope to drain the pipe and any joints or obstructions in the pipe do not block the passage of the ball.

EXERCISE 8-4

Discuss the following questions in your group. Class discussion begins in a few minutes.

1. Which tests do you think would be most appropriate for the drainage system? Why?

____

____

2. Who performs these tests?

____

____

STOP

EXERCISE 8-5

In your group, identify possible problems you might encounter with the ball test. Class discussion begins in five minutes.

____

____

____

____

____

____

STOP

THE WATER TEST

Another appropriate test for this inspection is the water test. As part of this test, it may be useful to actually walk on top of the pipe. It is easier to see if the pipe is leaking when you are closer to the pipe! Also, this allows you to get a better feel for the pipe support.

EXERCISE 8-6

Explain in your own words how the water test is performed. How long should this test be performed for? Work by yourself; class discussion begins in a few minutes.

____

____

____

____

____

Code Ref: ______________________________________

EXERCISE 8-7: Testing in Your Municipality

Municipalities may differ in the inspection tests they routinely perform. What tests are required in your municipality? Discuss this with your group for no more than five minutes.

STOP

COMMON DEFICIENCIES

Having gone through the checklist in this module, you now know what you are supposed to see on your first inspection. However, you are also likely to find a number of problems when you get out to the site.

EXERCISE 8-8

Listed below are a few typical deficiencies you may encounter. Read these; then, with your group, list other problems that you might run across. Those of you who inspect drains can relate the common deficiencies in your area. (Class discussion begins in 5 minutes.)

Common deficiencies:

STOP

DOCUMENTATION

As soon as you finish your inspection, you should write a report of what you have found. Some of the items to include in this report are:

- The date of your inspection
- Location—the legal description, including the lot number
- Permit number
- What you inspected (sanitary building sewer, storm building sewer, etc.)
- Who was present
- Type of material used
- Type of test(s) witnessed
- Any noncompliance with the Code

It is also useful to draw a sketch of the part of the plumbing system you have just inspected. That way, you can pinpoint exactly where the problems are. You can use this sketch to refresh your memory when you go back to reinspect. Furthermore, you can compare it to the drain plan filed by the contractor to see if they match. This is important, if major problems develop in the future.

If you are drawing a diagram of the sewers and drains, remember to size the pipes.

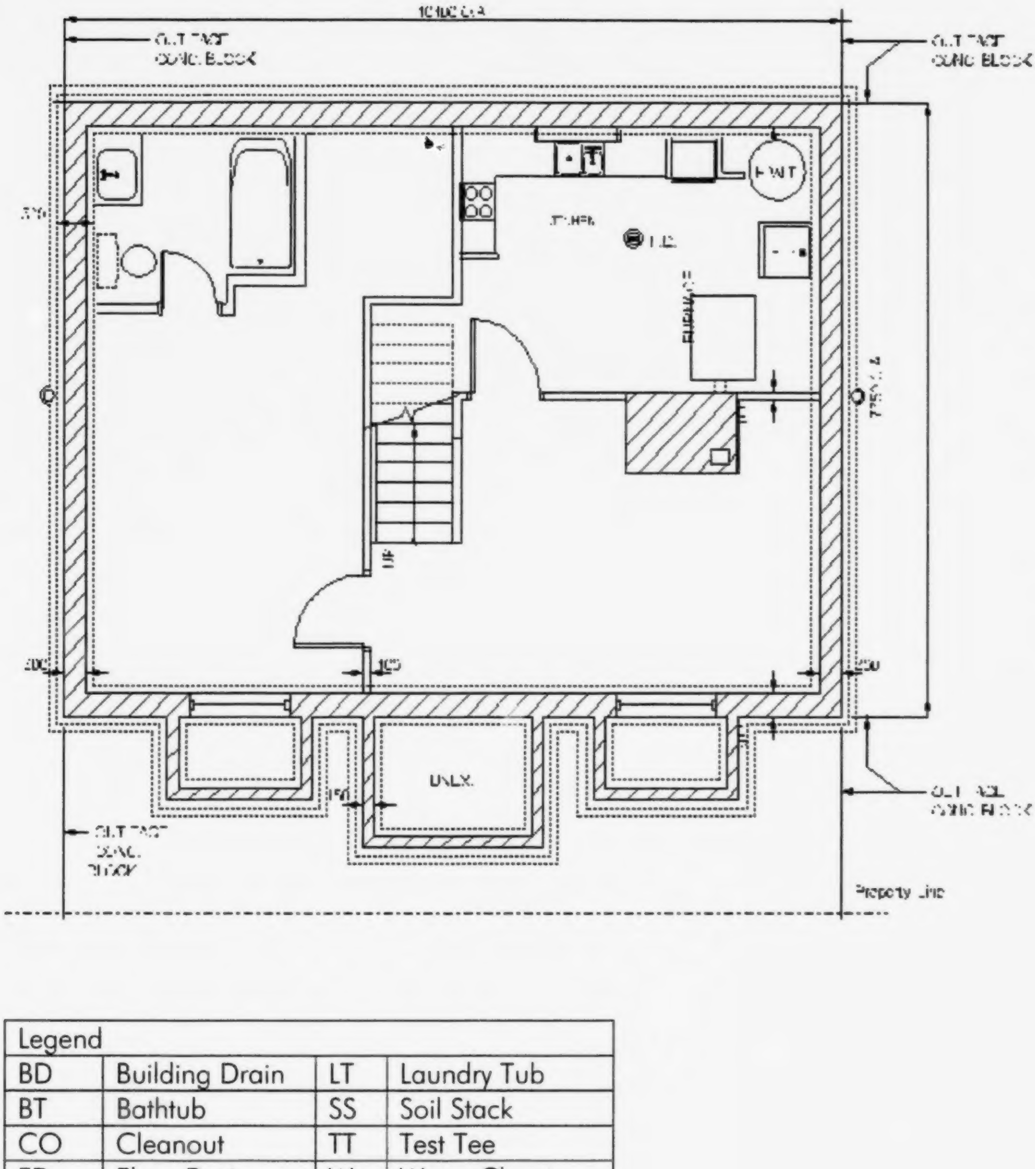
EXERCISE 8-9

Draw a drain plan for a single-family dwelling on Figure 8:4. Remember to name all the parts. Assume that combined sewers are not permitted in the area where the house is located.

Work on your own. Class discussion begins in five minutes.

STOP

Figure 8:4 BASEMENT FLOOR PLAN



Legend			
BD	Building Drain	LT	Laundry Tub
BT	Bathtub	SS	Soil Stack
CO	Cleanout	TT	Test Tee
FD	Floor Drain	WC	Water Closet
LAV	Lavatory	WS	Waste Stack

<u>EXERCISE 8-9:</u> Draw your own drain plan for the basement floor plan in Figure 8:4.

House

Property Line

EXERCISE 8-10: Down the Drain

You received a call to inspect the sewers and drains in the new mitec house in your town. Fully prepared, you went out to the site this morning, conducted your inspection, and witnessed a water test and a ball test. The contractor, "Down the Drain", has a reputation as the town's worst offender of the Ontario Building Code. After this morning's inspection, you're inclined to agree!

Your notes from the inspection should include the following items:

- Connections of the building sewer were leaking badly.
- The building drain pipe was 3" in diameter.
- The plastic sewer pipe sagged in several places.
- The installation passed the ball test.

Using these notes, write a report on today's inspection. The space below can be used as "scrap" for miscellaneous notes; use the next page for your report.

Inspection Report

STOP

ORDER TO COMPLY

The other kind of documentation that is necessary if a problem has been identified during your inspection is the Order to Comply. This must be written up right away and given to the contractor.

MODULE 8 QUIZ

1. What tests could be performed at the end of the sewer and drain inspection?

    a) Water and air
    b) Water and ball
    c) Smoke and water
    d) Water or air and ball

    Code Ref: ________________

2. When should you write an inspection report? After:

    a) The final inspection
    b) Every inspection
    c) The first inspection
    d) You have found a problem

3. A fixture unit is a:

    a) Water closet
    b) Count of the number of fixtures in the system
    c) Measure of slope
    d) Measure of hydraulic load

    Code Ref: ________________

4. The slope of the building sewer is tested by the:

    a) Ball test
    b) Water test
    c) Air test
    d) Smoke test

    Code Ref: ________________

5. Test tees connect the building:

   a) drain to the building sewer
   b) drain to the building storm drain
   c) sewer to the municipal sewer
   d) drain to the municipal sewer

6. When you find noncompliance with the code during an inspection, you should:

   a) Fix it yourself
   b) Tell the contractor how to fix it
   c) Ignore it
   d) Inform the permit holder of the contravention, and write it up in your report

7. Support for nominally horizontal piping underground shall be:

   a) Firm and continuous
   b) Hard and rigid
   c) Continuous concrete
   d) Blocks at 1200 mm spacing

   Code Ref: ________________

8. Underground horizontal piping is required to be covered with tamped backfill for a height of:

   a) 100 mm
   b) 300 mm
   c) 600 mm
   d) 1200 mm

   Code Ref: ________________

9. If underground horizontal piping is installed using hangers from a slab, the hangers are required to support the weight of:

   a) The pipe and its contents
   b) The concrete slab
   c) The pipe, its contents and the fill over the pipe
   d) Twice the weight of the pipe

   Code Ref: ________________

END OF MODULE 8

MODULE 9

STACKS AND WASTE PIPES AND THEIR INSPECTION

PLUMBING - HOUSE - 2007

MODULE CONTENTS Page

LEARNING OBJECTIVES

Upon completion of this module, participants will be able to:

- Explain the purpose of stacks and wastes in the drainage system.
- Plan and carry out an inspection of wastes and stacks in a single family dwelling.
- Define terms specific to wastes and stacks.
- List some common problems with the installation of wastes and stacks.
- Determine compliance and noncompliance with the Ontario Building Code as it relates to wastes and stacks.

STOP

INTRODUCTION TO INSPECTION OF STACKS AND WASTES

In general, this inspection occurs at the rough-framing stage of house construction.

Stacks and waste pipes are part of the sanitary-drainage system in a house, so this inspection is closely related to the inspection of sewers and drains and to the inspection of vents. In this phase, you will be inspecting:

- Stacks
- Waste pipes
- Fixture drains
- Traps and cleanouts
- Horizontal drainage piping, which includes branches of the building drain

What Are Stacks and Wastes?

Stacks are vertical soil, waste or vent pipes that serve one or more fixtures. In practice, you will find that stacks may include horizontal portions. This module concerns itself only with soil and waste stacks at this point.

A **waste pipe** is a sanitary drainage pipe that carries the discharge from a fixture directly to a waste stack, soil stack, sanitary building drain, and branch or sewage system.

A **soil pipe** is a sanitary drainage pipe that carries the discharge of a sanitary unit, with or without the discharge from any other fixture.

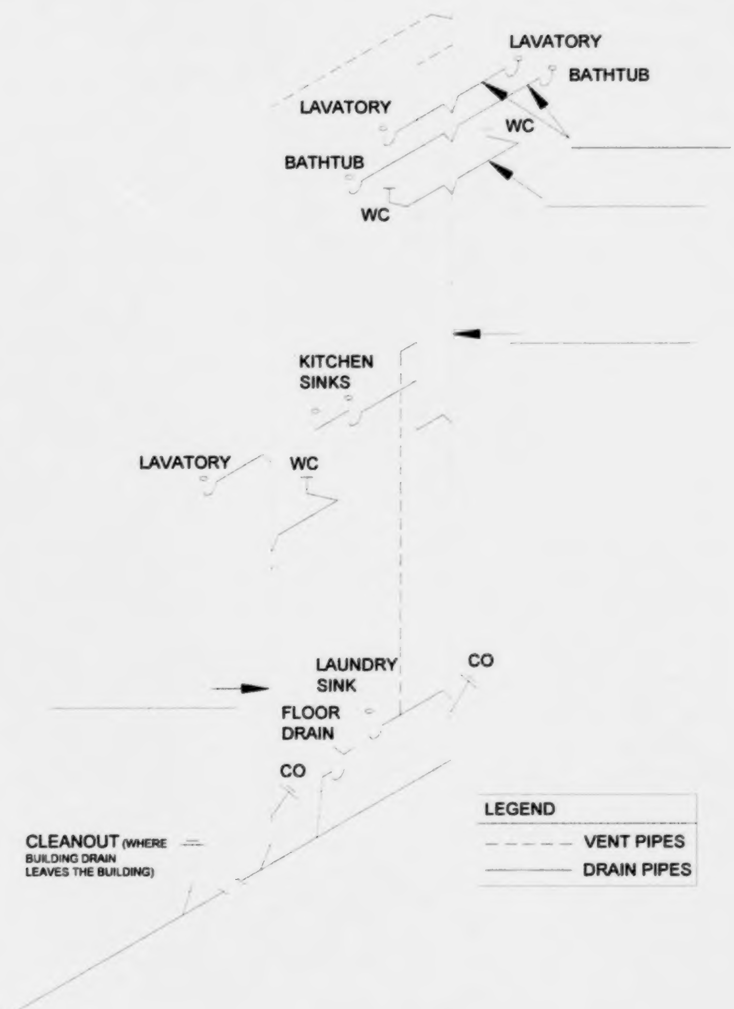
Understanding these two terms will help you in the next exercise.

EXERCISE 9-1

Take the next five minutes to identify the stacks and the waste pipes in the MITEC house with your group. Although this is a group exercise, identify the stacks and waste pipes on your own copy of Figure 9:1 for future reference.

STOP

FIGURE 9:1 STACKS AND WASTES



PREPARATION FOR THE INSPECTION

This is the first inspection step to be done at the rough-in stage of plumbing. How will this differ from other inspections, when it comes to deciding how to prepare?

EXERCISE 9-2

Take about five minutes to develop a step-by-step list of things you would do to prepare to carry out this inspection phase. Work within your group and write your list on your flipcharts.

STOP

PLAN REVIEW

EXERCISE 9-3

The plans for the MITEC house are in Appendix A. Review them for information about its stacks and waste pipes.

Within your groups, see what you can tell about the system of stacks and wastes in the MITEC house. Answer the questions following. Note your conclusions on the flipchart and be prepared to justify your answers.

1. Each fixture must be serviced by a waste or soil pipe. How many waste pipes must there be in the MITEC house? How many soil pipes?

2. What type of drainage stacks would you expect to find in the MITEC house?

STOP

DEFINITIONS

The Ontario Building Code defines the following terms, which are specific to stack and waste pipes in the sanitary drainage system. You should make sure you understand each of them.

EXERCISE 9-4

In a short while, the facilitator will assign each group five terms to define. Write the definitions for each of your terms clearly on your flipchart. You may want to make note of some of the more complicated terms.

1. Bottle trap
2. Branch
3. Building drain
4. Cleanout
5. Clear water waste
6. Dead end
7. Developed length
8. Directly connected
9. Drainage system
10. Drum trap
11. Fixture drain
12. Fixture outlet pipe
13. Horizontal branch
14. Indirectly connected
15. Nominally horizontal
16. Nominally vertical
17. Offset
18. Sanitary drainage pipe
19. Sanitary drainage system
20. Sanitary sewage
21. Sanitary sewer
22. Sanitary unit
23. Soil pipe
24. Soil stack
25. Trap
26. Trap dip
27. Trap seal depth
28. Trap standard
29. Trap weir
30. Waste pipe
31. Waste stack

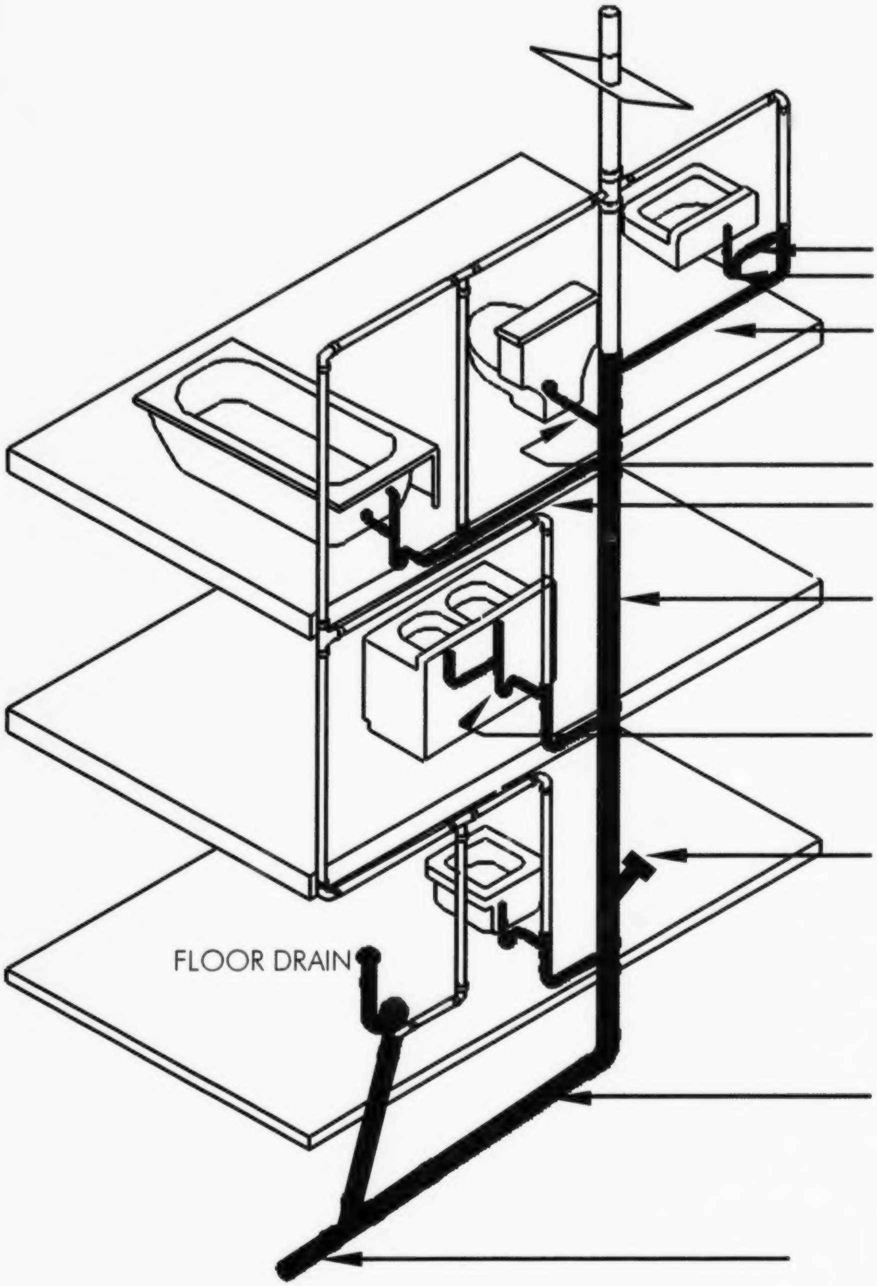
EXERCISE 9-5

Locate the following terms of the drainage system on Figure 9:2.

Building drain
Building sewer
Cleanout
Fixture drain
Fixture outlet pipe
Horizontal branch
Soil pipe
Soil stack
Trap
Waste pipe

STOP

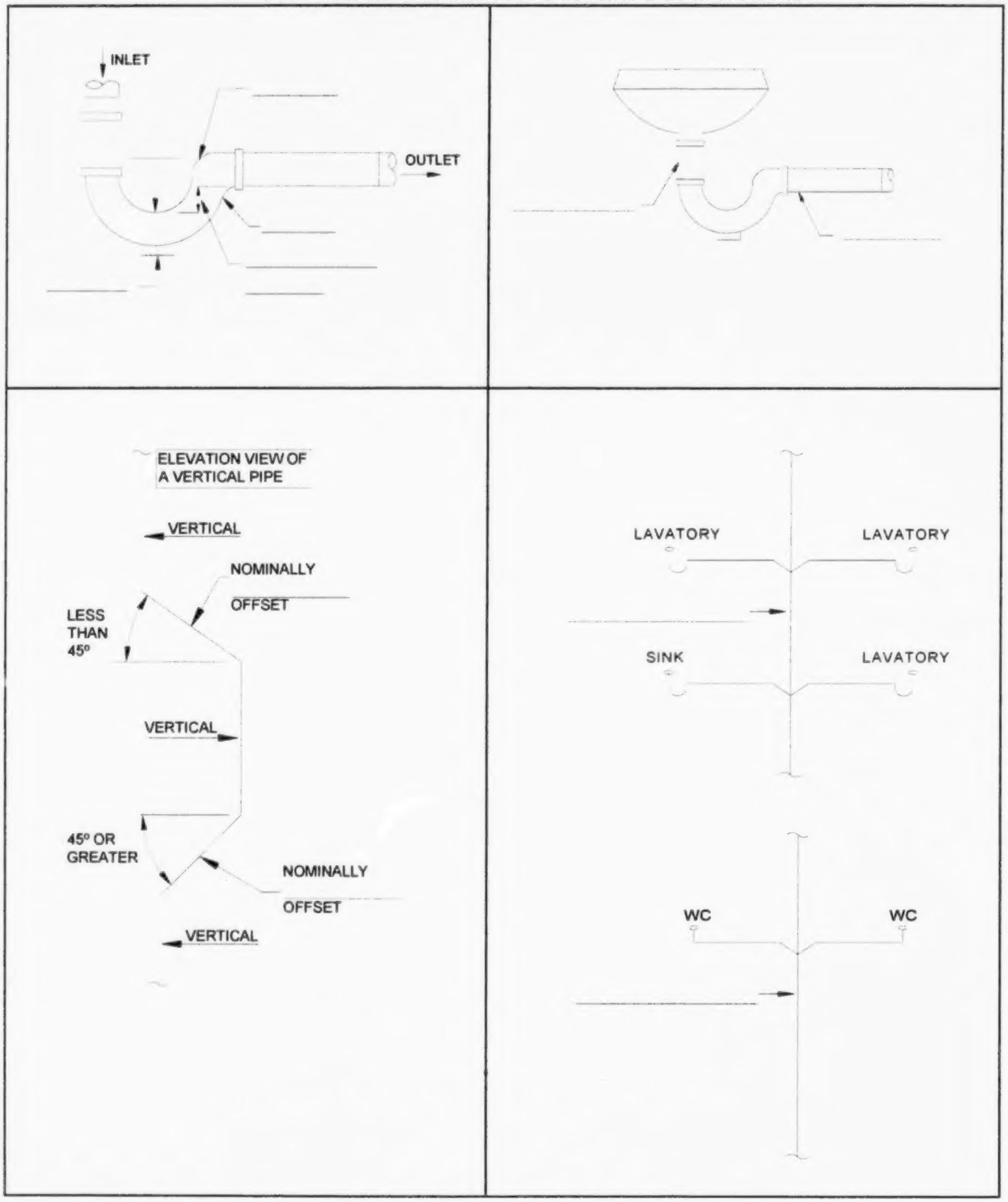
FIGURE 9:2 DRAINAGE SYSTEM DEFINITIONS



EXERCISE 9-6

Label the sketches below by working on your own, then discuss the terms with your group. Use the definitions in the OBC for reference.

9:3 MORE DRAINAGE SYSTEM DEFINITIONS



EXERCISE 9-7: Site Conditions

A new contractor in your area calls you for an inspection of stacks and waste pipes. When you arrive at the site, it is apparent that he is not ready for this inspection. The frame has just been erected and the drainage system is just beginning to be installed. Some of the stacks and wastes are in place, but by no means all of them.

What he has done so far looks fine, and as far as you can remember, so did his plans: after all, you reviewed them. This is your busiest time of year, and you can't afford to waste any of your valuable inspection time.

What should you do?

Should you assume the installation will be fine because it's okay so far? Should you get angry? Should you charge him for an extra inspection? Should you inspect what he has done so far and come back again?

What would you do in this situation? Discuss it with your group for five minutes, and make notes on the flipchart.

MATERIALS

In older homes, cast iron, galvanized steel and lead are the materials most commonly found in stacks and wastes. Today it is more common to find plastic piping in this part of the drainage system.

The regulations regarding the use of plastic piping in the drainage system are found in Subsection 7.2.5., Nonmetallic Pipes and Fittings.

EXERCISE 9-8

Read Subsection 7.2.5., paying particular attention to the specifications for the drainage system. Then take a few minutes to answer the following questions on your own.

1. Under what circumstances can you use CAN/CSA-B181.2-02 PVC piping?

   ____

   ____

   ____

   Code Ref: ____________
   Code Ref: ____________
   Code Ref: ____________

2. When using asbestos-cement piping in the drainage system, what minimum standards must you observe?

   ____

   ____

   Code Ref: ____________

3. Is vitrified clay pipe acceptable in the drainage system? If so, where and under what conditions?

   ____

   ____

   Code Ref: ____________

STOP

USE OF FERROUS PIPE

The term "ferrous" refers to materials such as cast iron and galvanized steel.

Cast iron piping **may be used** in the sanitary-drainage system, **if**:

- The pipe, fittings and any mechanical coupling equipment associated with it are **certified to CSA Standard B70-02** Sentence 7.2.6.1.(1)
- Cast iron fittings designed for use with asbestos cement pipe is **certified to CSA Standard B127.1-99** - Article 7.2.6.2.

Galvanized steel piping is **permitted** in a drainage system **when**:

- It is used **above ground**—Sentence 7.2.6.7.(2)
- It is used with **drainage fittings**—Sentence 7.2.6.7.(5)
- It conforms to **ASTM Standard A53**—Sentence 7.2.6.7.(4)
- Steel piping of **4" size or smaller is schedule 40** or heavier and the **fittings of less than 2" size are galvanized screw fittings**—Sentence 7.2.6.7.(6)

NONFERROUS PIPES

This term refers to such materials other than iron or steel such as copper, brass, lead and aluminum. The regulations affecting the use of these materials in the drainage system appear in Subsection 7.2.7.

EXERCISE 9-9

Read Subsection 7.2.7., making sure you understand Table 7.2.7.4. Then complete the following sentences with the information you found in the Code.

1. It is acceptable to use brass pipes in the drainage system if they conform to the following standards:

   ____

   ____

   Code Ref: ________________

2. Several types of copper piping are not allowed in above-ground stacks and waste pipes. They are:

   ____

   ____

   Code Ref: ________________

3. Lead can be used in stacks and wastes as long as the following conditions are observed:

   ____

   ____

   Code Ref: ________________

STOP

SIZING OF DRAINAGE PIPES

The concept of hydraulic load and sizing of drainage pipes was covered in Module 6. A summary of the key points for sizing drainage pipes is provided here. Refer back to Module 6 if you have any questions.

EXERCISE 9-10: Review of Sizing Drain Pipes and Stacks

Use Subsections 7.4.9. and 7.4.10. and take five minutes to answer the following questions on your own. When you are finished, discuss your answers with your group to see if you all agree.

1. What size of horizontal sanitary drainage pipe is necessary to service two fixture outlet pipes, one from a bathtub and one from a lavatory with 1½" trap?

____

____

____

____

Code Ref: ____________________

2. What size would the horizontal sanitary-drainage pipe have to be if a water-closet fixture outlet also discharges into the horizontal sanitary drainage pipe in question 1?

____

____

Code Ref: ________________

3. What is the hydraulic load for a fixture having a 2" trap that is not listed in Table 7.4.9.3.?

____

____

Code Ref: ________________

4. If you have a horizontal sanitary drainage pipe smaller than 3", what is the maximum number of water closets that may feed into it?

____

____

Code Ref: ________________

5. There are differences between the maximum percentage of flow capacity allowable for loading on a horizontal sanitary drainage pipe versus a vertical sanitary drainage pipe. What are their limitations according to the OBC? Why?

____

____

____

Code Ref: ________________

6. What size of soil stack (i.e. serving water closets) is required for a total load of 20 fixture units in a 3 storey building?

____

____

Code Ref: ________________

7. If you have a drainage capacity of 41 gallons per minute, what is the maximum number of fixture units you can have?

____

____

Code Ref: ________________

8. If you were to install a horizontal sanitary drainage pipe with its slope at 1:100 and a hydraulic load of 41 fixture units, what size of piping must you use?

____

____

Code Ref: ________________

9. How many fixture units are there in the plumbing system of the MITEC house (refer to drawing in the Appendix)?

____

____

Code Ref: ________________

10. What is the minimum size of the stack in the MITEC house?

____

____

Code Ref: ________________

11. How many flush tank water closets can be connected to a 4" horizontal branch with a slope of 1:100?

____

____

Code Ref: __________________

STOP

SLOPE AND LENGTH

Subsection 7.4.8. lays out the minimum requirements for slope and length for drainage pipes. It is important to remember three things about this item:

- Every drainage pipe of 3" diameter or less must have a grade of at least 1:50 in the direction of the flow.
- If this is not possible due to some building constraint, then a slope that will produce a gravity flow of at least 0.6 metres per second is permissible, at the discretion of a plumbing inspector.
- No fixture outlet pipe shall exceed 1200 mm in developed length.

This is not the only part of the Code that regulates slope. Remember the exercises on loading and Table 7.4.10.8. This Table sets out the slope required for any drainage pipes of 3" and over. Take a few minutes to review it now

EXERCISE 9-11

1. Write the definitions from Division A, Part1 of the OBC for:

Nominally horizontal means ________________________________

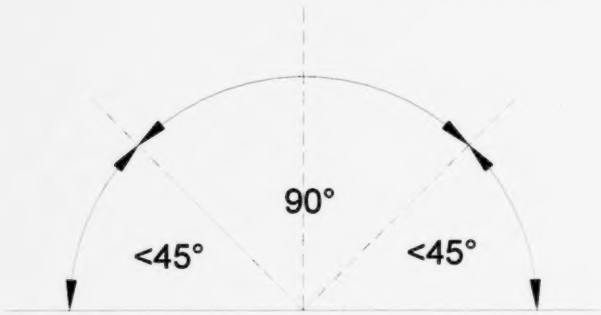
____

Nominally vertical means ________________________________

____

2. Indicate on the figure the pipes that are nominally vertical and the pipes that are nominally horizontal.

FIGURE 9:4 Nominally Vertical and Nominally Horizontal



STOP

CONNECTIONS

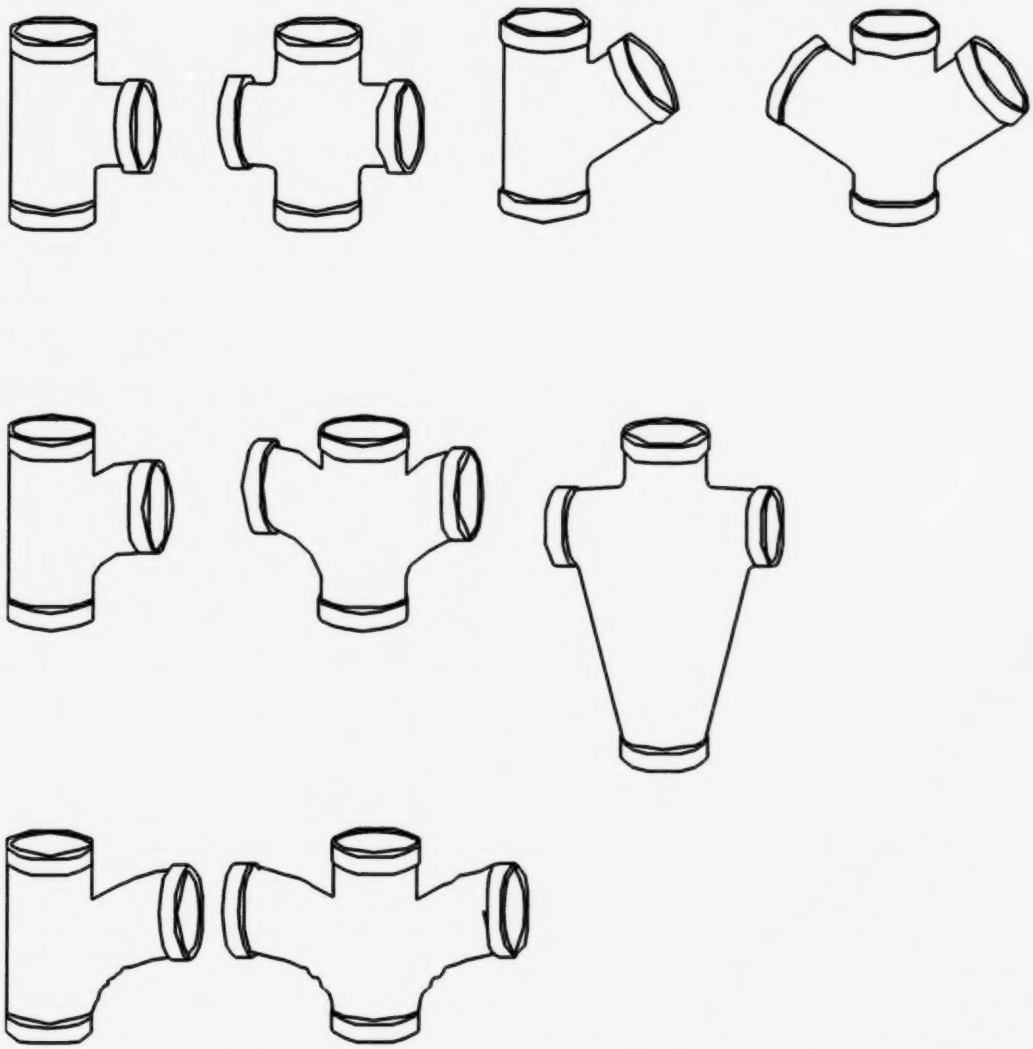
Table 7.2.4.5. of the OBC has diagrams of several different drain, waste and venting connection fittings that are acceptable.

- Straight tee
- Double tee or cross
- Sanitary tee or short-turn tee-wye
- Double sanitary tee or short-turn double tee-wye
- Combination wye and 1/8 bend or long-turn tee-wye
- Double combination wye and 1/8 bend or double long-turn tee-wye
- Wye
- Double wye
- Double waste fitting

<u>EXERCISE 9-12</u>

Working alone, see if you can match the terms above to the diagrams in Drawing 9:7. Then turn to Table 7.2.4.5. of the Code and correct your answers.

FIGURE 9:5 DWV FITTINGS



STOP

PIPE FITTINGS

The use of proper fittings is very important in the drainage system. If the wrong fitting is used, the result can be quite dramatic. For example, if two water closets (WCs) were connected to the main stack with a cross-fitting, when one was flushed the waste would travel across the system to the other. You can imagine the effect this would have on anyone using the other WC!

Try to think of the practical reason for each of the requirements while reading this section.

Subsection 7.2.4. sets out the requirements for the types of connections acceptable in a drainage system. **Refer to Table 7.2.4.5. in the OBC when you read the examples below** so you can picture the fitting and understand the reason why certain fittings are not permitted in specific situations.

For example, **tee fittings cannot be used except for connecting a vent pipe to a drainage pipe** - Sentence 7.2.4.1.(1).

No cross-fittings are permitted in a **drainage system** - Sentence 7.2.4.1.(2).

A **double sanitary tee fitting** shall **not be used** to connect the **fixture drains of two urinals** where no cleanout fitting is provided above the connection.

A pipe fitting, joint or connection that would tend to hinder solids or **reduce the flow through a pipe by more than 10%** may **not be used** in a plumbing system.

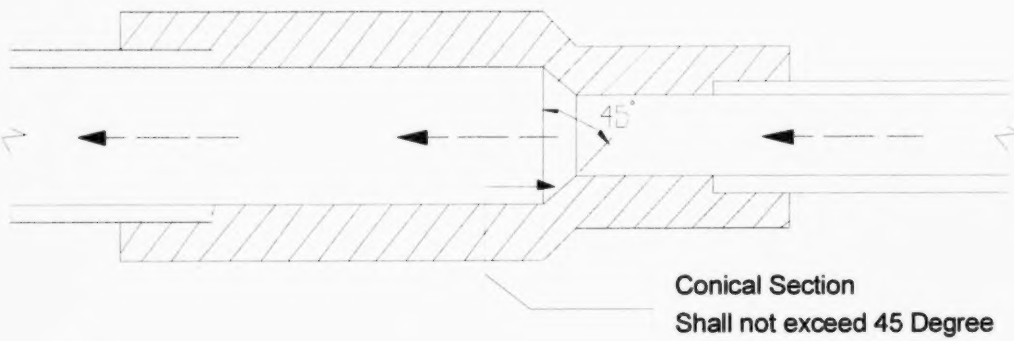
CONNECTIONS BETWEEN DIFFERENT SIZES OF PIPES

Connecting a larger pipe to a smaller pipe must be done by use of a fitting. The fitting connecting the two pipes requires a conical cross-section, with the angle between the centre line and the side of the cone not exceeding 45°. No pipe adaptation may be made with a bushing that leaves a square edge or shoulder on the inside of the pipe or fitting—Sentence 7.3.3.1.(5).

Figure 9:8 should help you to understand these requirements. Every connection between two pipes of different size requires an increaser or reducer fitting, installed so that complete drainage of the system remains possible—Article 7.3.3.5.

A drainage pipe or fitting may be drilled or tapped to provide for the connection of a trap-seal primer line, and to provide for the connection of the pipe or fittings to metal or rigid plastic pipe and fittings where the pipe or fittings are thick enough to be threaded or are bossed for tapping—Article 7.3.3.1.

FIGURE 9:6 INCREASER/REDUCER FITTING



EXERCISE 9-13: Joints and Connections

Subsection 7.3.3. sets out some additional requirements for connections. Read this through, to see which requirements apply to stacks and waste pipes in the drainage system. Then take five minutes to answer the following questions.

1. If a fixture or device is indirectly connected, how must the connection be made?

   ____

   ____

   Code Ref: ______________________

2. Where a lead water-closet stub is used, what length of the stub must be below the floor flange?

   ____

   ____

   Code Ref: ______________________

3. Some pipe adaptations are made by use of bushings. If you adapt a pipe in this manner, what must you avoid?

   ____

   ____

   Code Ref: ______________________

4. Where should a slip joint not be used?

   ____

   ____

   Code Ref: ______________________

SUPPORT

The following are some general rules for the support of piping as laid out in Subsection 7.3.4.

The plumbing system must be installed so that all piping is supported **to bear the weight of the pipe** and **its contents and to keep the pipes in alignment**. Article 7.3.4.1. is the most important requirement when it comes to the support of stacks and wastes.

Stacks are vertical pipes and must be supported **every 7.5 m or less, or every two storeys,** whichever is less - Article 7.3.4.4.

It is also important to make sure that **piping, fixtures, tanks or devices are supported independently of each other** - Article 7.3.4.2.

Nominally horizontal piping must be **braced to prevent swaying and buckling**, and to control the effects of thrust. The maximum interval between points of support is indicated in Sentence 7.3.4.5.(2) of the Ontario Building Code.

EXERCISE 9-14: Support

Read Article 7.3.4.5. and then write out the support requirements for each type of material. You can do this with your group, but make notes in your own workbook for future reference. Make sure you use your own words and note the appropriate sections of the Code.

STOP

TRAPS AND CLEANOUTS

So far we have not discussed traps and cleanouts, which are integral parts of the drainage system. Here, we'll outline the reasons why it is necessary to include traps and cleanouts in a plumbing system and the parts of the Code that apply to them.

A trap is nothing more than a downward loop in the piping (See Figure 9:7) that allows waste or sewage to pass through but prevents sewer gases from entering the house through the fixture. Trap requirements are addressed in Subsection 7.4.5. and Article 7.2.3.1. of the OBC.

Traps must be included on all fixtures. Floor-drain traps are usually made of whatever material is used in the drainage piping, whereas fixture traps can be cast iron, copper, brass, or plastic. The most common material for traps in a single-family dwelling is plastic.

As stated in Sentence 7.2.3.1.(1) of the Code, every trap must:

- Have a **trap seal depth of at least 38 mm**
- Be so designed that **failure of the seal walls will cause exterior leakage**
- Have a **water seal that does not depend on the action of moving parts.**

FIGURE 9:7 THE TRAP

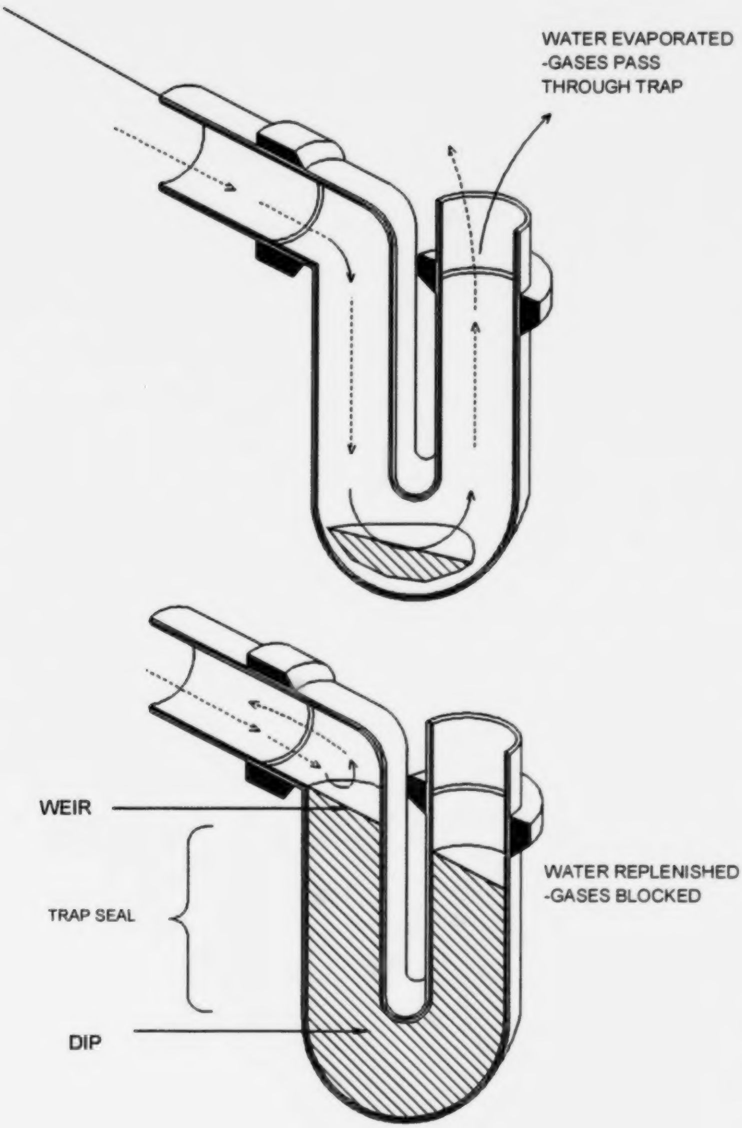
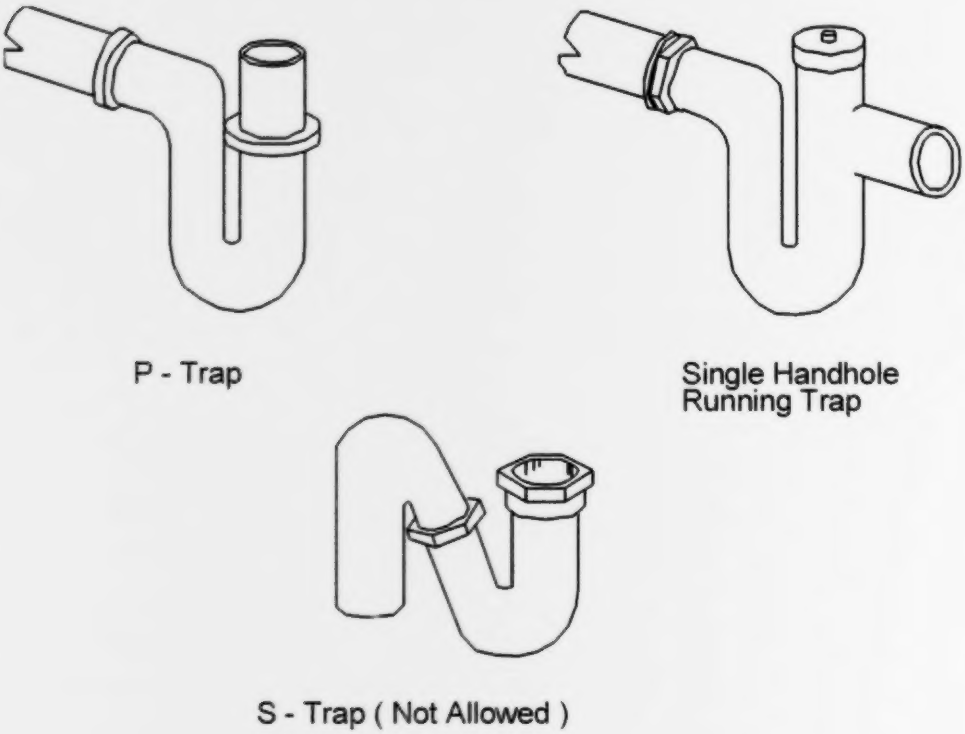


FIGURE 9:8 TYPES OF TRAPS



EXERCISE 9-15

Sentences 7.2.3.1.(1) to (8) state what types of traps are allowed and where. Using these sentences and the definitions in the Code, complete the chart below.

APPROPRIATE USES OF TRAPS
(Reference Subsection 7.2.3.)

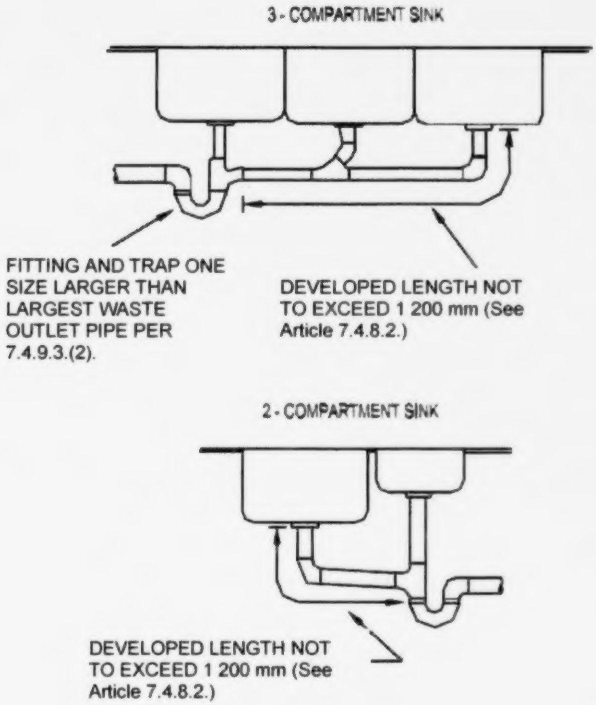
Type of Trap	Sketch	Appropriate Uses and Code Reference
Bell trap		
Bottle trap		
Drum trap		
P-trap		
S-trap		

STOP

TRAPS PROTECTING MULTIPLE FIXTURE OUTLET PIPES

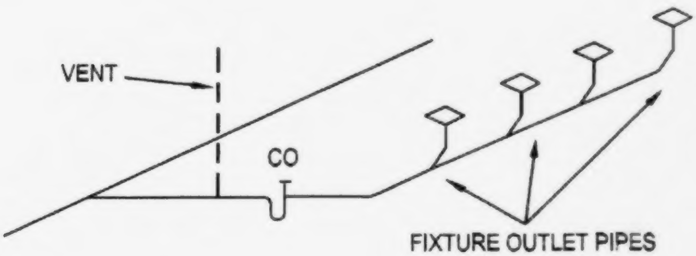
1. A single trap protecting a two- or three-compartment sink

FIGURE 9:9 Compartment Sinks



2. Gang-trapping floor drains located in the same room

FIGURE 9:10 Gang-Trapped Floor Drains



CLEANOUTS

A **cleanout** is a fitting installed in the drainage or venting system that **provides access to the system for inspection and cleaning** (Drawing 9:12).

According to Sentence 7.2.3.1.(3) of the Code, every P-trap serving a lavatory, sink or laundry tray must be provided with a cleanout plug:

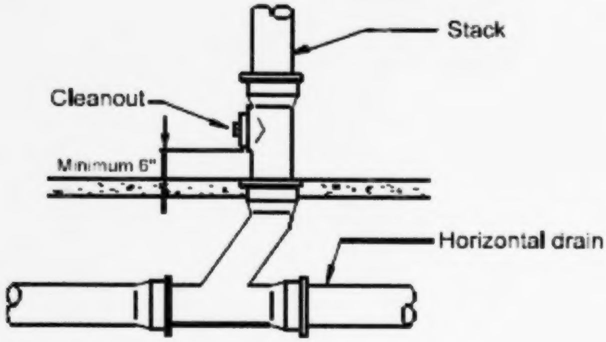
- ¾" or more in diameter
- located at the lowest point of the trap
- made of the same material as the trap (except that a cast iron trap requires a brass cleanout plug), or
- designed so that part of the trap can be completely removed for cleaning purposes

In addition, Article 7.2.10.3. states that:

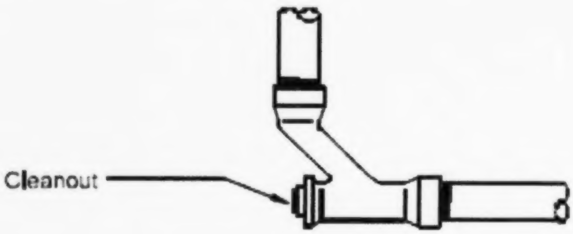
- Every cleanout plug, cap, nut or bolt that is intended to be removable from a ferrous fitting must be made of a nonferrous material.
- A cleanout fitting must be able to withstand the physical stresses of removal and reinstallation as a result of normal maintenance operations and also ensure a gas-tight seal.
- A screw cap or test cap may not be used as a cleanout plug or cover.

Besides the above requirements, there is also an entire Subsection dedicated to cleanouts – Subsection 7.4.7. This subsection states where cleanouts are required for drainage systems.

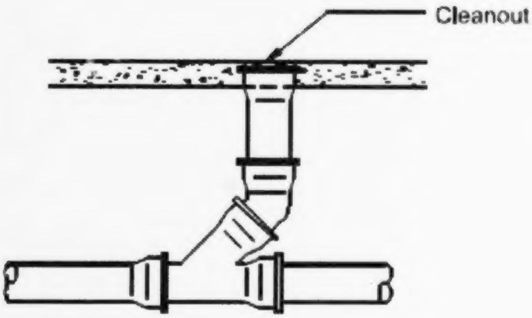
FIGURE 9:11 EXAMPLES OF CLEANOUTS



Stack base cleanout



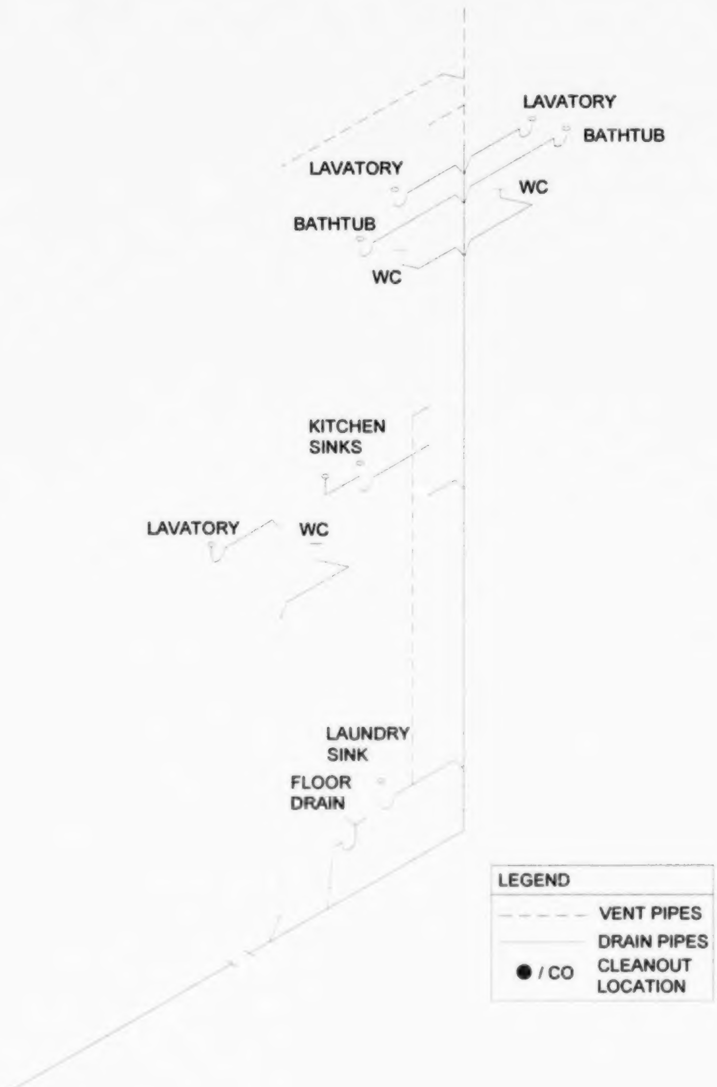
Cleanout at a 90° change in direction



EXERCISE 9-16: Cleanouts

Read through Subsection 7.4.7. in the Code. Using the information you learn, indicate all the places you would expect to find a cleanout in the MITEC house on Figure 9:12

FIGURE 9:12 CLEANOUTS



TESTING

EXERCISE 9-17

Subsection 7.3.6 states which tests may be done on the drainage and venting system. Read through this Subsection; spend five minutes discussing the following questions with your group. Use your flipchart.

1. Which of the four tests outlined in this Subsection are suitable during inspection of drainage and venting system?

   ____

   ____

   ____

   Code Ref:________________________________

2. Which tests must be done at the wastes and stacks inspection?

   ____

   ____

   Code Ref:________________________________

3. When would you recommend an air test?

   ____

   ____

   Code Ref:________________________________

4. Where would you use a ball test?

   ____

   Code Ref:________________________________

5. How are final tests performed?

____

Code Ref:__________________________________

STOP

COMMON DEFICIENCIES

There are many problems you may encounter when checking the installation of stacks and waste pipes. The following are some of the more common ones:

- Not enough slope in nominally horizontal drainage pipes
- Bowing of pipes due to incorrect cutting and notching of joists
- Incorrect size of pipe used

There are probably a number of other problems which you have encountered.

EXERCISE 9-18

Within your groups, come up with a list of deficiencies that are common to the inspection of stacks and wastes.

Common deficiencies of stacks and waste pipes:

____

____

____

____

____

____

____

____

____

____

____

____

STOP

DOCUMENTATION

EXERCISE 9-19

This may be the second or third inspection report you will have to write. Think back to your last set of field notes and decide what information you will have to add or delete.

Take a few minutes to discuss this with your group and then come up with a list of important things to note when doing the inspection report for stacks and waste pipes. Write your list on your flipchart.

Checklist for the third inspection:

Notes:

STOP

MODULE REVIEW

Take the next 10 minutes and go back through this module, noting the major issues covered. This will help prepare you for the test that follows.

If you have time, compare your list with your group members to see if they have noted the same points.

Major points in Module:

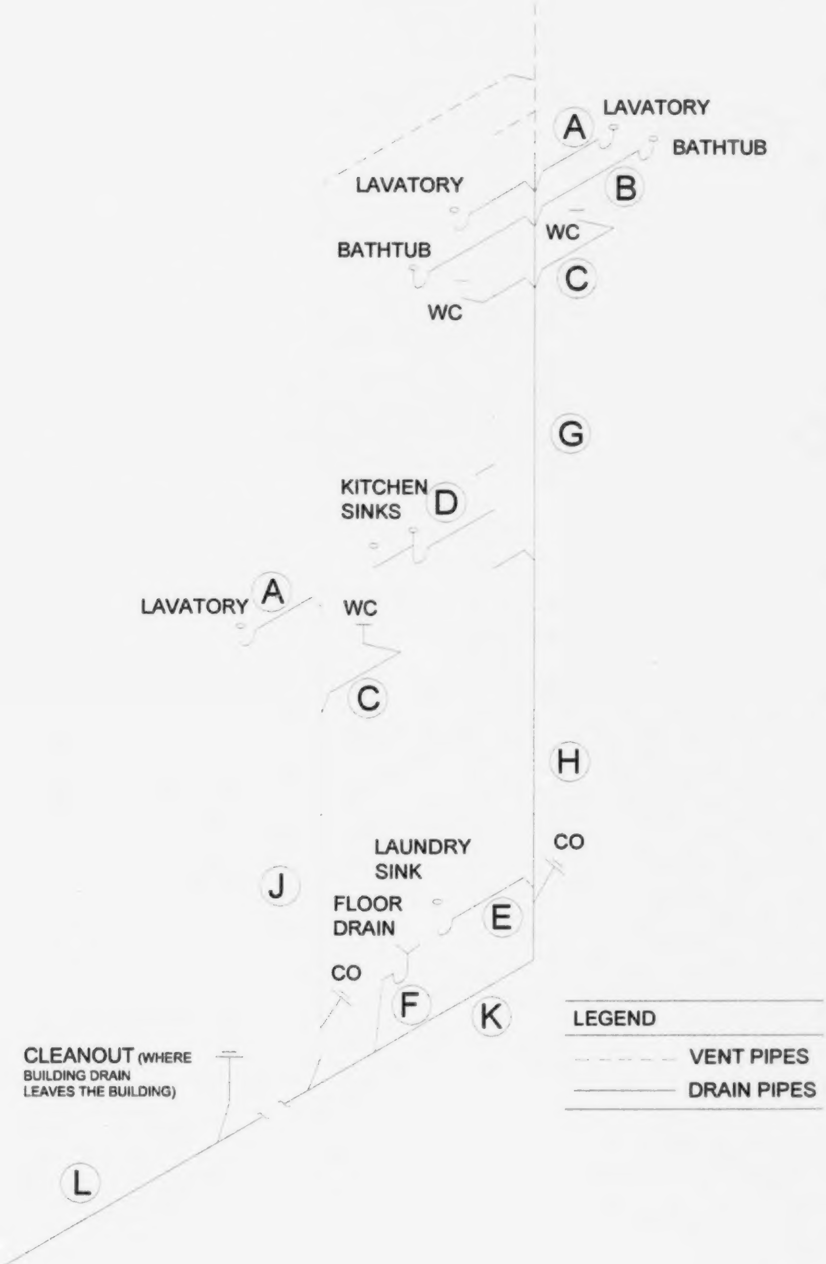
STOP

EXERCISE 9-20

As part of your review, **indicate the minimum size of the drainage pipes** in the MITEC house plumbing system on Figure 9:13. Use the table following the diagram to write the sizes and Code references.

If required, look back to Figure 9:1 where you labeled the parts of the drainage system.

FIGURE 9:13 MINIMUM SIZES OF DRAIN PIPES



EXERCISE 9-20 (continued)

Pipe	Drain Pipe / Drain Pipe Serving	Size (in.)	Reference
A			
B			
C			
D			
E			
F			
G			
H			
J			
K			
L			

MODULE 9 QUIZ

1. Which of the following is not a part of the system of stacks and wastes?

   a) Soil stack
   b) Building drain
   c) Waste pipe
   d) Horizontal branch
   Code Ref: ________________

2. Which of the following can be used as a trap on a fixture in a single-family dwelling?

   a) S-trap
   b) P-trap
   c) Bell trap
   d) Drum trap
   Code Ref: ________________

3. Which of the following best describes a trap seal?

   a) The CSA stamp imprinted on all suitable trap materials
   b) The connection between the fixture outlet pipe and the trap
   c) An endangered species being protected by the Greenpeace organization
   d) The liquid in the trap that prevents sewer gases from entering the house
   Code Ref: ________________

4. The most common material for stacks and waste pipes in a new single-family dwelling is:

   a) Galvanized steel
   b) Cast iron
   c) Polymeric plastic
   d) Vitrified clay
   Code Ref: ________________

5. Which of the following is a true statement about the size of stacks and wastes?

   a) No soil or waste pipe shall drain into other drainage pipe of lesser size
   b) Every waste pipe that serves a WC must be at least 2" in diameter
   c) Every stack that serves more than six WCs must be a minimum of 3" in size
   d) A horizontal drainage pipe serving three or more WCs must be at least 3" across

   Code Ref: ________________

6. Every drainage pipe of 3" or less shall have a downward slope in the direction of flow of at least

   a) 1:25
   b) 1:50
   c) 1:100
   d) 1:125

   Code Ref: ________________

7. Which of the following statements about fittings in the drainage system is true?

   a) Cross-fittings are permitted in the drainage system
   b) A T fitting is not permitted in a venting system
   c) A double Y fitting cannot be installed in a nominally horizontal drainage pipe
   d) A double TY fitting can be installed in a nominally horizontal drainage pipe

   Code Ref: ________________

8. How do you calculate the hydraulic load on a pipe?

   a) 33% of the total load of all fixtures
   b) Total load from all fixtures
   c) 65% of the total load of all fixtures
   d) Total load from every fixture and roughed-in fixtures upstream of the pipe

   Code Ref: ________________

9. Vertical waste pipes must be supported at intervals that do not exceed:

   a) 7.5 m or 2 storeys, whichever is lesser
   b) 5 m or 2 storeys, whichever is lesser
   c) 3 m
   d) Every storey

   Code Ref: ________________

10. Which of the following tests should be done during the inspection of stacks and waste pipes?

    a) Final test
    b) Water or air test
    c) Ball test
    d) A test is never required

    Code Ref: ________________

11. One of the common problems you may come across when inspecting waste pipes is:

    a) No pressure-relief valves on the hot-water tanks
    b) Too little slope in horizontal drainage pipes
    c) Incorrect vent connections
    d) Non-certified fixtures

12. What types of copper tubing and piping are permitted in above-ground drain and waste pipe?

    a) M hard
    b) M hard & M soft
    c) K & L soft
    d) K & L hard

    Code Ref: ___________________

13. Every trap shall have a minimum trap-seal depth of:

    a) 18 mm
    b) 28 mm
    c) 38 mm
    d) 48 mm

    Code Ref: ___________________

14. A cleanout plug in a P-trap must have a minimum diameter of:

    a) The same size as the trap
    b) ½"
    c) ¾"
    d) Half the size of the trap

    Code Ref: ___________________

15. A drain or an overflow from a heating system may be directly connected:

    a) To a pipe and terminated above the flood-level rim of a fixture, to form an air break
    b) Downstream of a trap supplied with a cleanout
    c) Below the flood-level rim of a fixture
    d) To a sanitary-drainage system

    Code Ref: ___________________

END OF MODULE 9

MODULE 10

VENTING SYSTEMS AND THEIR INSPECTION

PLUMBING - HOUSE - 2007

MODULE CONTENTS

LEARNING OBJECTIVES

Upon completion of this module, participants will be able to:

- Explain the importance of venting.
- Plan and carry out an inspection of the venting system.
- List some problems, which commonly occur in venting.
- Identify compliance and noncompliance within the venting system.
- Define terms specific to the venting system

STOP

INTRODUCTION

The next phase in the inspection process is the inspection of the venting system. The Code devotes an entire section, Section 7.5., to venting. You will be familiar with Section 7.5. by the time you have completed this module.

It is logical to inspect this system immediately after (or at the same time as) stacks and waste pipes, because venting and stacks and wastes are very closely related. In fact, stacks sometimes make up part of the venting system.

PURPOSE OF VENTING

Venting is an integral part of the plumbing system. The **venting** system is an assembly of pipes and fittings that connect a drainage system with open air, for the circulation of air and the protection of trap seals in the drainage system. When waste is discharged from fixtures, air is displaced in the vents to maintain the atmospheric pressure differential in the drainage piping. This reduces the possibility of siphonage and back-pressure.

The regulations governing venting have been written to achieve three goals:

- A safe and sanitary plumbing system
- A drainage system that functions properly
- The use of a minimum amount of piping to conform with the Code

These goals are reflected in the objectives and functional statements that are linked to venting provisions in Section 7.5.

Some of the objectives linked to venting are OH1.1, OH 2.1, OH 2.3 and OS3.4. The full objectives can be found in Division A. These objectives relate to the protection of health and safety.

There are four functional statements that are linked to venting requirements.

F40 To limit the level of contaminants.

F72 To provide facilities for the sanitary disposal of human and domestic wastes.

F80 To resist deterioration resulting from expected service conditions.

F81 To minimize the risk of malfunction, interference, damage, tampering, lack of use or misuse.

Supplementary Standard SA-1 shows the specific functional statements for each requirement.

EXERCISE 10-1: To Vent or Not to Vent

Carol, one of the plumbing inspectors for the City of North Decode, was reviewing some plumbing permit applications that had been processed while she was on vacation. She came across a file listing a renovator whose name she didn't recognize. "Hmm, must be new to the area," she thought. "I'd better take a good look at this one".

This new plumbing contractor was obviously trying to play by the rules. He applied for a permit, paid his fees, even submitted two sets of drawings—one of the water distribution system and one of the drainage system. "Nice of him," Carol said to herself; "we don't even require plans. I wonder if anybody looked at these?"

She looked over the water-distribution system. "Looks like he knows what he's doing." Then she looked at the plans for the drainage system. "Oh-oh, no venting on these plans at all. Is this just an oversight on the plans, or does he not understand about venting? I wonder what he intends to do?"

As these thoughts went through her head, Carol checked the date the permit was issued and realized that it would be at least a month before he would be calling for his first rough-in inspection.

What should she do in the meantime?

____

____

____

____

____

____

____

STOP

INTRODUCTION TO DEFINITIONS

Approximately 17 terms relevant to the venting system are defined in the Code. The most common terms that you are likely to come across in an inspection of the venting system in a house are listed below; some are not necessarily defined in the Code.

1.	Back vent	7.	Trap Arm
2.	Branch vent	8.	Vent pipe
3.	Continuous vent	9.	Vent stack
4.	Fresh air inlet	10.	Venting system
5.	Stack vent	11.	Wet vent
6.	Stack venting	12.	Vent terminal

<u>EXERCISE 10-2</u>

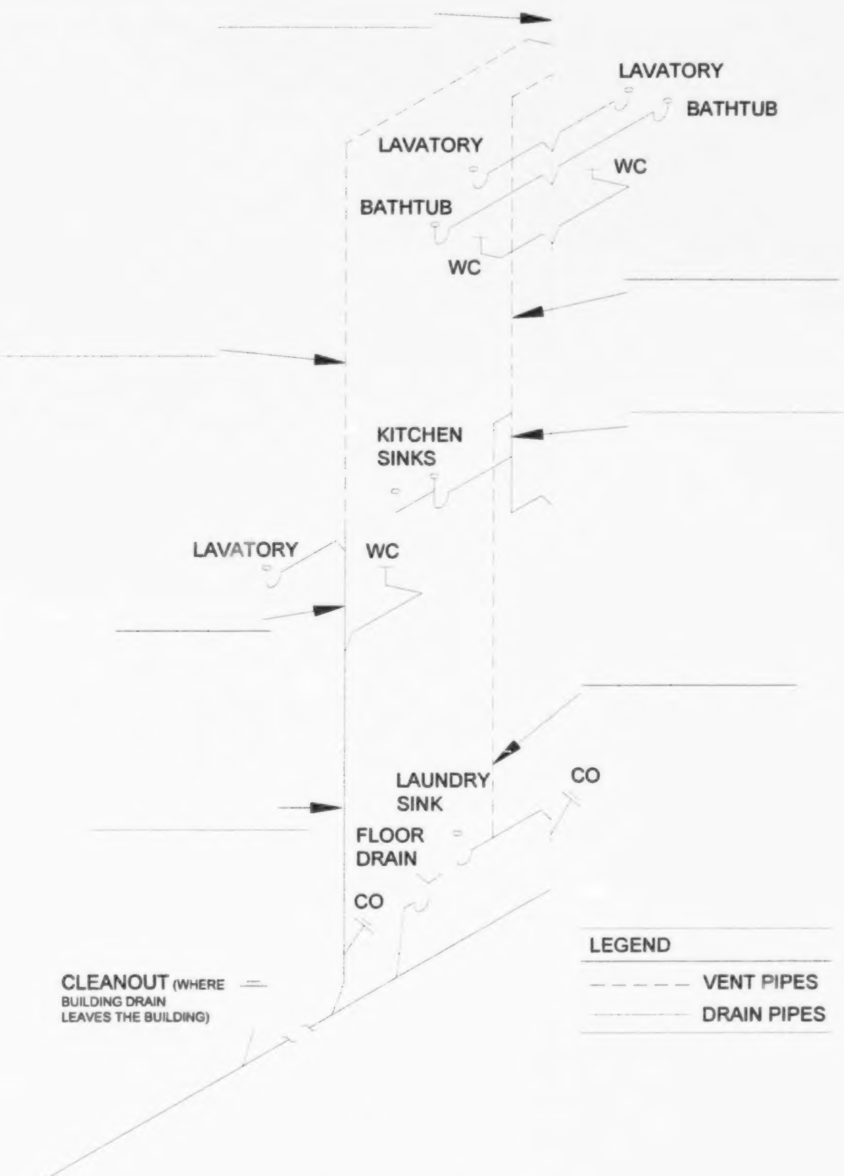
You will not find a vent stack (item 9) in the MITEC house, because this type of vent is not required in residential buildings of four storeys or less (See Sentence 7.5.4.2.(1) of the Code).

In a few minutes, your facilitator will have you look up these definitions in the Code and then have you label the venting system on Figure 10:1, a diagram of the MITEC house plumbing system. Not all terms are represented on the drawing.

As this is a group exercise, each person in the group should be responsible for looking up two or three definitions and then locating them on Figure 10:1.

We will return to venting definitions and types of vents after looking at vent materials and location of vent pipes.

Figure10:1 Venting in the MITEC House



STOP

SITE CONDITIONS

The house should still be at the rough framing stage of construction when you inspect the venting system. All the venting pipes should be exposed, so that you can check:

- Materials
- Location of vent pipes
- Size and loading
- Slope
- Connections
- Support

and so that water or air test can be performed.

MATERIALS

The regulations for materials are covered in Section 7.2. of the Ontario Building Code. Subsection 7.2.5. covers **nonmetallic materials** and stipulates the following requirements **for vent pipes**:

According to Sentence 7.7.5.12.(1), plastic pipe, fittings and solvent cement used inside or under a building in a sanitary drainage system or venting system must be certified to:

- CAN/CSA-B181.1, "ABS Drain, Waste, Vent Pipe and Pipe Fittings"
- CAN/CSA-B181.2, "PVC Drain, Waste, Vent Pipe and Pipe Fittings"

In addition, plastic pipe, fittings and solvent cement used inside a building in a storm drainage system must be certified to:

- CAN/CSA-B181.1, "ABS Drain, Waste, Vent Pipe and Pipe Fittings"
- CAN/CSA-B181.2, "PVC Drain, Waste, Vent Pipe and Pipe Fittings"
- CAN/CSA-B182.1, "Plastic Drain and Sewer Pipe and Pipe Fittings"
- CAN/CSA-B182.2, "PVC Sewer Pipe and Fittings (PSM Type)"

Note: plastic pipe used as described above requires stiffness equal or greater than 320 kPa as per Sentence 7.2.5.12.(3).

Finally, solvent cement for transition joints must conform to Article 7.2.5.11.

EXERCISE 10-3

What does ABS and PVC stand for in plumbing? Don't look them up, write down what you think they mean and then check in Article 7.2.5. of the Code.

1. ABS stands for

____

Code Ref:__________________________________

2. PVC stands for

____

Code Ref:__________________________________

If you got ABS, give yourself a pat on the back and appoint yourself head of your trivia team.

STOP

FERROUS AND NONFERROUS PIPES

Subsection 7.2.6. regulates the use of **ferrous pipes in the venting system**. These requirements permit the use of cast-iron piping in the venting system as long as it is certified to CAN/CSA-B70. Galvanized steel is also permitted, as long as it meets ASTM Standard A53/A53M.

The use of nonferrous piping, including copper, bronze, and brass is covered in Subsection 7.2.7. Note that aluminum is not a referenced pipe material in the OBC.

Article 7.2.7.4. regulates the use of certain types of copper in the plumbing system. The uses differ, depending on whether the pipe is above or below the ground. For example, you can use M hard copper tubing above ground, but not underground.

Look at Table 7.2.7.4. and see what other types of copper are permitted and prohibited.

Sentence 7.2.7.5.(1) sets out the standards for solder-joint fittings. They must be certified to Standard ASME B16.23 "Cast Copper Alloy Solder Joint Drainage Fittings: DWV", or ANSI/ASME B16.29, "Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV".

<u>EXERCISE 10-4</u>: Materials Permitted in the Venting System

You have just read about all the different types of materials that are acceptable for use in the venting system, but the information is spread out over several pages.

Put all this information into one chart. Use the following chart, or adapt your own version.

Do this exercise with your group and develop your answer on the flipchart. Be sure to make a copy in your book for future reference.

Materials Permitted in the Venting System
(See Subsections 7.2.5., 7.2.6., 7.2.7.)

Type of Pipe Material	Applicable Standard	OBC Reference	Application in Venting Systems
ABS			
PVC			
Cast iron			
Galvanized steel			
Copper tube			
Brass			

STOP

LOCATION OF VENT PIPES

As you have already learned, each waste pipe is connected to a trap that serves the fixture. The waste pipe must be installed properly to ensure the waste flows away smoothly, quietly and does not siphon the trap. The pipe that connects a trap serving a fixture to another part of the drainage system is called a fixture drain.

The 2006 OBC includes a new term **trap arm**, which means that portion of a fixture drain between the trap weir and the vent pipe fitting. **Trap arm requirements are in Article 7.5.6.3.**

Five factors must be considered when inspecting a trap arm and the location of the vent pipes serving the trap:

1) Minimum length
2) Minimum slope
3) Maximum length
4) Total fall maximum change in direction

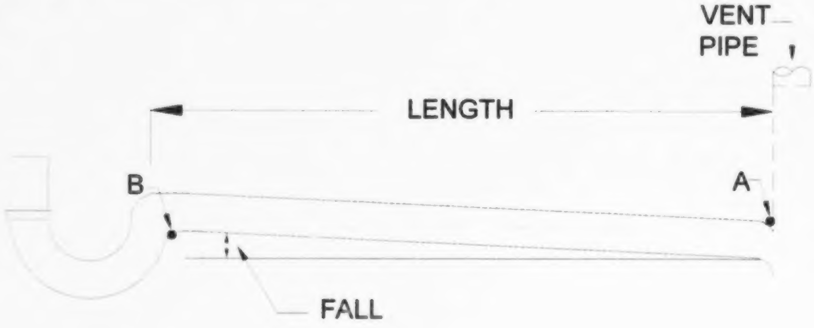
A crown vent is a vent connected to a fixture waste pipe on top of the crown of the trap. This is not acceptable in a plumbing system because of the close proximity of the trap. Experience has shown that grease, hair and other clogging materials splash into the vent pipe to accumulate there and finally close the vent. Also there is some evidence that because the vent is so close to the water that surface evaporation is increased. **This is why the code requires the minimum length of the trap arm to be not less than twice the size of the fixture drain – Clause 7.5.6.3.(1)(a).**

In order to promote self-cleansing flow, the **minimum slope** in the direction of flow is 1 in 50 for all drainage pipes - Table 7.5.6.3.

There are two reasons for establishing **maximum distance** between a trap and its vent as shown in Table 7.5.6.3. Remember that one end of the waste pipe is blocked with the trap, and it is also desirable to have fresh air circulating through the drainage piping to carry away gases. Therefore the farther away the vent, the more piping that is not ventilated.

Another reason for establishing a **maximum distance** is to prevent the loss of a trap seal through self-induced siphonage. The loss of a trap seal could occur if the highest point of the drainage pipe meeting the vent pipe is lower than the weir of the trap.

Figure 10:2 Trap Arm Length and Fall



The maximum distance of a trap arm in the 2006 OBC depends on the size of trap served.

The maximum distance of a trap arm is still 1.5 metres for traps up to 2 inches. This ensures that in the case of the smallest size waste pipe (1 ¼ inch), the point at which air is admitted to the waste pipe, when minimum slope is applied, is not lower than the weir level.

Greater distances are permitted for larger traps, and a trap arm can be up to 5 metres for a 6 inch pipe. See Table 7.5.6.3. for all trap sizes.

There is a fixed relationship between the maximum distance allowed between a trap and its vent, the minimum slope and the total fall. The code requires that the total fall of the trap arm is not greater than its inside diameter. The reason for this is the same as above – air should not be let into the waste pipe lower than the trap weir.

The code requires that the trap arm does not have a cumulative change in direction of more than 135 degrees (with the exception of water closets, see 7.5.6.3.(2)). This allows the flow of waste to move with as little restriction as possible.

Example: 135 degrees can be reached by many combinations of bends, including:

- Three 1/8 bends
- One 1/8 bend and one 1/4 bend

Where a drainage pipe of a WC discharges through a floor assembly, it must be installed in accordance with Sentence 7.5.6.3.(3) which states that the vent pipe be located not more than 1 m vertically and 3 m horizontally from the connection of the fixture drain to the fixture.

EXERCISE 10-5

For each requirement below, put down the code reference and describe in your own words why the requirement is important.

1. The **minimum developed length** of a trap arm.

____

____

____

____

____

Code Ref:______________________________________

2. The **minimum slope** of all trap arms.

____

____

____

____

____

Code Ref:______________________________________

3. The **maximum range of length** of a trap arm. Explain why the permitted length increases as the trap size increases.
   OBC Reference:

Code Ref:

4. The **total fall** in the trap arm.

Code Ref:

5. The **change in direction** permitted in a trap arm.

Code Ref:

STOP

TYPES OF VENTS

It is very important to understand what each venting term means and to be able to visualize each type of vent. Although you will typically not see the more complex types of vents in houses, you should be familiar with all venting terms.

At the beginning of the module we reviewed some definitions of the most common types of vents. We will review these and more venting terms now before learning how to size vent pipes.

As previously discussed, the venting system exists to protect trap seals in a drainage system. So let's start with the vent terms that are closest to the traps.

Sentence 7.5.1.1.(1) states that every trap shall be protected by a **vent pipe**.

<u>EXERCISE 10-6</u>

The definition of **vent pipe** is:

____

____

Code Ref: __________________________________

The terms **individual vent** and **dual vent** are generally taken to mean a vent that serves an individual trap or a vent that serves two traps.

EXERCISE 10-7

1. The definition of **continuous vent** is:

____

____

Code Ref: ________________________________

2. The definition of **back vent** is:

____

____

Code Ref: ________________________________

3. How does a **continuous vent** differ from a dry vent connected to a horizontal branch?

____

____

Code Ref: ________________________________

4. Label the drawings in Figure 10:3 appropriately.

Figure 10:3 Types of Vents

1.____________________

2.____________________

3.____________________

4.____________________

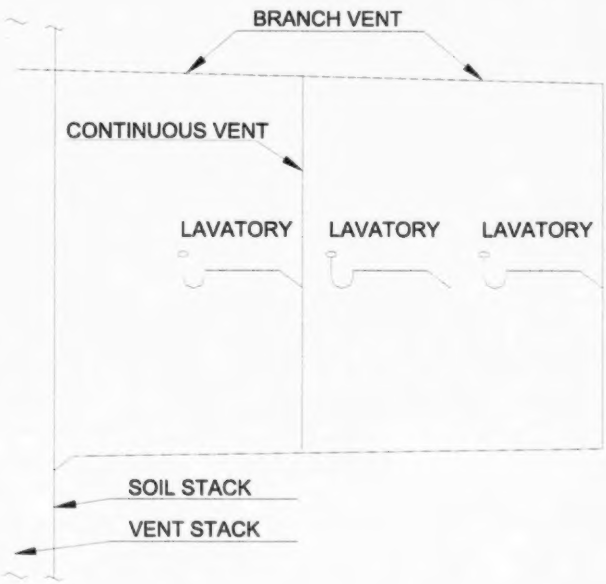
Sentence 7.5.1.1.(1) of the Code states that every trap (with a few exceptions) must be vented. Read Sentences (3) and (4) of Article 7.5.1.1. to see where venting is not necessary.

The implication of Sentence 7.5.1.1.(1) is that a venting system typically requires a large number of vent pipes. Plumbers, however, like to economize on piping as much as permissible. This is done by sharing vents, by using stacks as vents, and by having a number of branch vents connect to a larger vent.

BRANCH VENT

A branch vent connects two or more vents on one end and carries them over to a larger vent. The larger vent can be another branch vent, a vent stack, a stack vent, or a header. A branch vent is typically nominally horizontal, although there are no restrictions on its orientation.

Figure 10:4 Branch Vent



Note: Diagram for purpose of illustrating a branch vent only.

EXERCISE 10-8

The definition of **branch vent** is:

____

____

Code Ref: ______________________________________

STOP

WET VENTING

A wet vent is simply a waste pipe that is also serving as a vent pipe.

Article 7.5.2.1. allows a soil or waste pipe to serve as a wet vent provided certain conditions are satisfied.

One of the conditions is that the hydraulic load drained to a wet vent does not exceed what is permitted – Clause 7.5.2.1.(1)(a). This requirement is very important to ensure the wet vent will have adequate capacity to perform both drainage and venting functions.

We will look closer at hydraulic loading of the wet vent when we size the wet vent later in this module, but always keep in mind that loading on a wet vent is restricted.

There are a number of conditions for wet venting in Article 7.5.2.1. These conditions are examined individually below with corresponding figures.

Figure 10:5 Maximum 2 Wet Vented Water Closets

A **maximum of 2 water closets** can be wet vented on one stack - Clause 7.5.2.1.(1)(b)

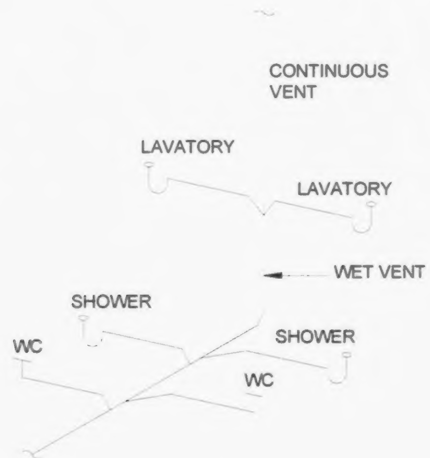


Figure 10:6 Wet Vented Water Closets Connected With a Double Fitting

If **2 water closets** are wet vented they must be **connected** at the same level to a vertical part of the stack with a **double fitting** - Clause 7.5.2.1.(1)(c)

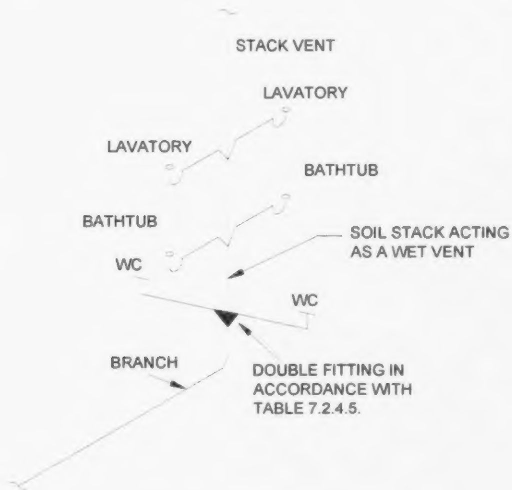


Figure 10:7 Wet Vented Water Closet Location

Water closets must be downstream of all other fixtures - Clause 7.5.2.1.(1)(c)

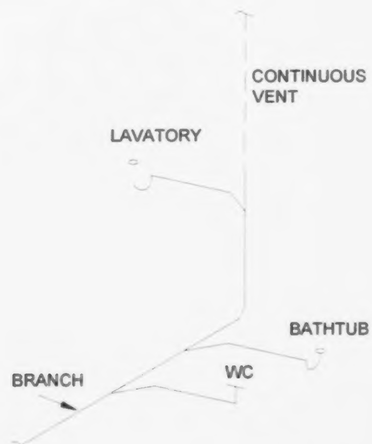


Figure 10:8 Maximum Size of Wet Vented Drain Pipes

Maximum 2 in. size trap arms and fixture drains (except floor drains not less than 3 in. are permitted if installed as per 7.5.1.1.(3)) – Clause 7.5.2.1.(1)(e)

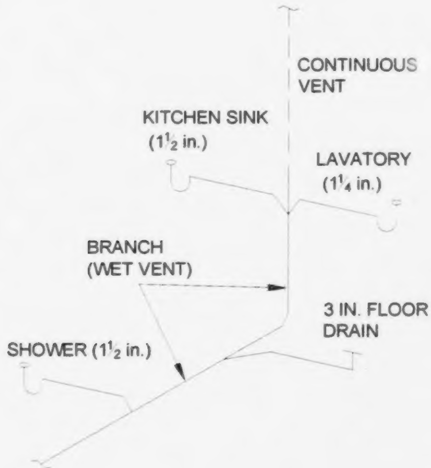


Figure 10:9 Separately Vented Fixtures Draining to a Wet Vent

Other **separately vented fixtures** on the same storey with a **total hydraulic load up to 2 fixture units** can drain to the wet vent - Clause 7.5.2.1.(1)(f)

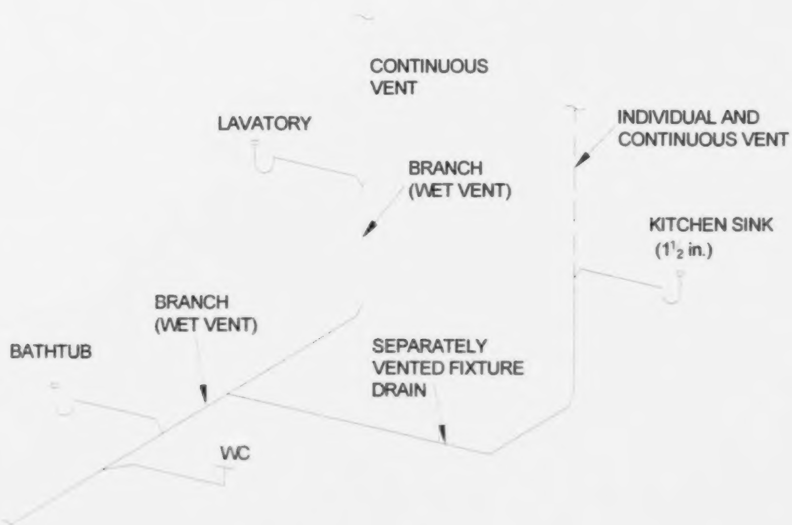


Figure 10:10 Multiple Storey Wet Vent - Maximum Hydraulic Load Per Storey

Wet vents can extend through multiple storeys, but the total hydraulic load drained to the wet vent is **a maximum of 4 fixture units per storey** – Clause 7.5.2.1.(1)(h)

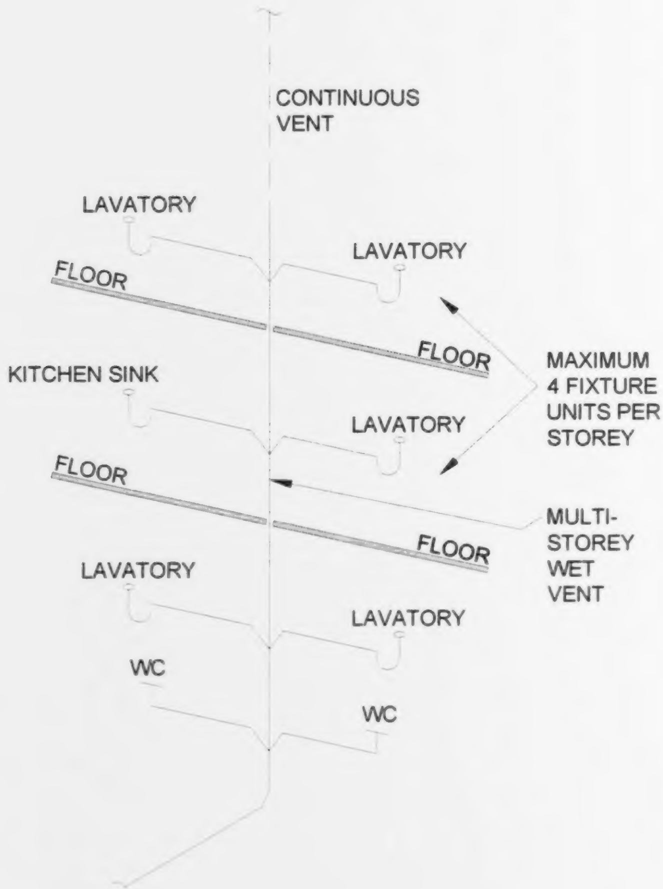


Figure 10:11 Horizontal Offset of a Wet Vent

Only **one nominally horizontal offset** of a restricted length is permitted - Clause 7.5.2.1.(1)(i). Maximum length of offset is 1200 mm for pipes 2 in. or less in size, and 2500 mm for pipes larger than 2 in. in size.

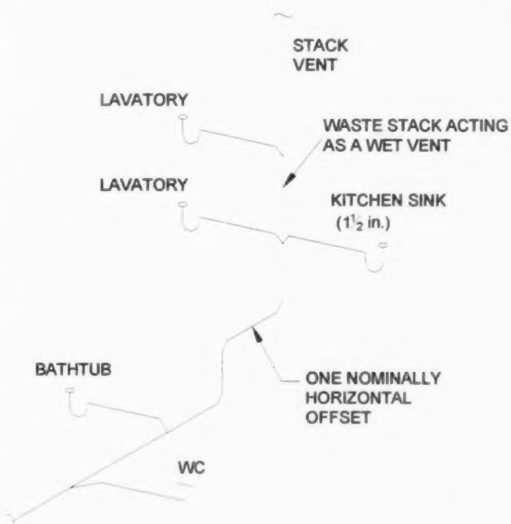
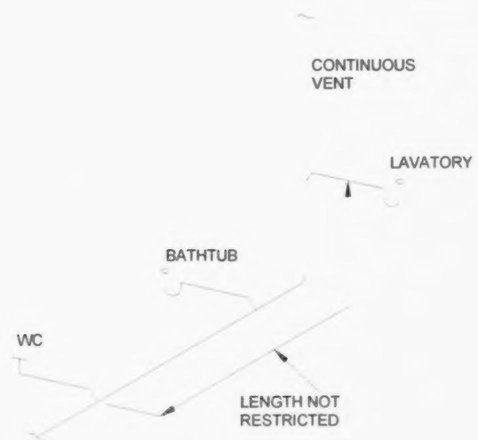


Figure 10:12 No Reduction in Size of a Wet Vent

The wet vent cannot be reduced in size except for the portion upstream of floor drains - Clause 7.5.2.1.(1)(j)

Figure 10:13 Wet Vent Length Not Restricted

The **length** of a wet vent is **not limited** - Clause 7.5.2.1.(1)(k)



One other condition that is not illustrated above is that the hydraulic load to consider when sizing a continuous vent that serves a wet vent is the hydraulic load that is wet vented. – Clause 7.5.2.1.(1)(g)

EXERCISE 10-9

List the advantages and disadvantages of wet venting below:

____

____

____

____

____

____

____

____

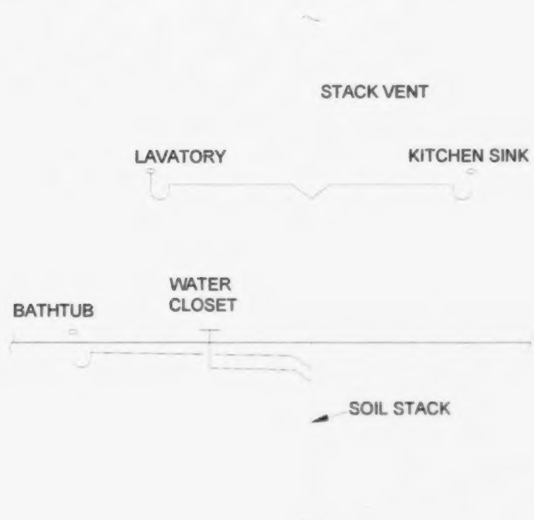
STOP

STACK VENTING

One of the most common venting arrangements in a single family dwelling is stack venting the fixtures located in a washroom on the top floor. Stack venting is defined in Division A as *"an arrangement such that the connections of the drainage piping from the stack vented fixtures to the stack provide venting to the fixture traps so that no additional vent pipe is required."*

Stack venting is essentially using the stack as a wet vent as seen in Figure 10:14 below.

Figure10:14 Stack Venting



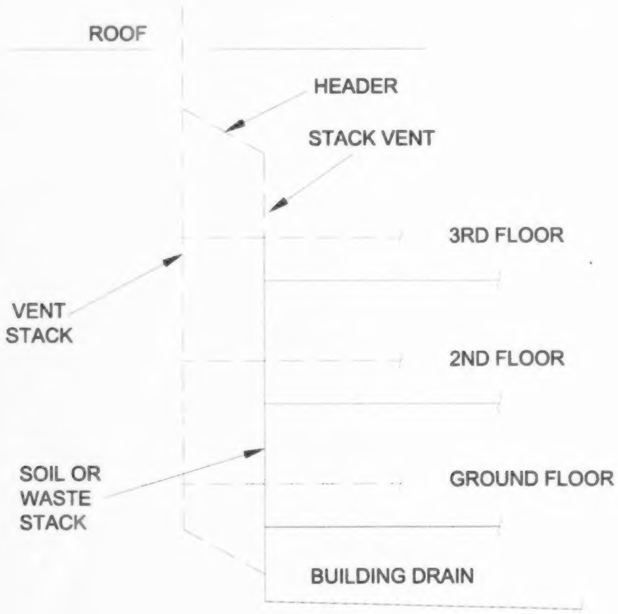
VENT STACK, STACK VENT AND HEADER

A **vent stack** is a vertical vent pipe that connects to a soil or waste stack at the bottom, and terminates at a header or in open air. A **stack vent** is a vertical vent pipe that extends from a soil or waste stack, and terminates at a header or in open air.

A **header** connects the tops of vent pipes and terminates in open air. A header can connect any combination of vent stacks, stack vents or other types of vents.

Vent stacks are not often seen in houses, but it is illustrated below for learning purposes.

Figure10:15 Vent Stack and Stack Vent



EXERCISE 10-10

1. The definition of **vent stack** is:

____

____

Code Ref: ________________________________

2. The definition of **stack vent** is:

____

____

Code Ref: ________________________________

3. The definition of **stack venting** is:

____

____

Code Ref: __________________________

4. The definition of **header** is:

____

____

Code Ref: __________________________

5. What is the difference between a **stack vent** and **stack venting**?

____

____

Code Ref: __________________________

6. What is the difference between a **vent stack** and a **stack vent**?

____

____

Code Ref: __________________________

STOP

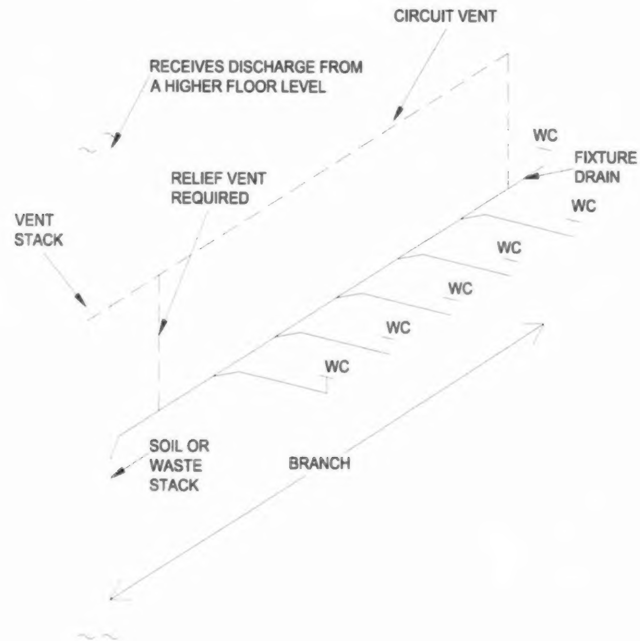
OTHER VENTS NOT OFTEN SEEN IN HOUSES

Other types of vents not often seen in houses are circuit vent, relief vent, offset relief vent, and yoke vent.

A **circuit vent** provides venting from the upstream end of a drainage pipe.

A **relief vent** is often required in combination with a circuit vent to provide more air circulation, and is installed downstream of the circuit vented fixtures.

Figure10:16 Circuit Vent and Relief Vent



An **offset relief vent** is required to vent the horizontal offsets for soil or waste stacks that serve more than 2 storeys and more than 100 fixture units.

Yoke vents provide a connection between a soil or waste stack and a vent stack in buildings more than 11 storeys in height, so you will not see a yoke vent in a house!

Consult Division A for these definitions.

IDENTIFICATION OF DIFFERENT TYPES OF VENTS

Now that you are more familiar with vents, try your hand at drawing some vents you will likely have in a house.

<u>EXERCISE 10-11</u>

Take five minutes to sketch the following types of vents without referring to the Code or to other modules. Space is provided on the next page.

1. Back vent
2. Branch vent
3. Continuous vent
4. Dual vent (a common use term not defined in the Code)
5. Stack vent
6. Wet vent

STOP

EXERCISE 10-11 Illustrate the different types of vents.

BACK VENT	DUAL VENT
BRANCH VENT	STACK VENT
CONTINUOUS VENT	WET VENT

VENT SIZING

Vents are sized in two ways. Individual and dual vents are sized based on the largest trap served as per Table 7.5.7.1.

Other vents such as branch vents, headers, continuous vents and circuit vents are sized based on the hydraulic load served by the vent and the maximum length of the vent pipe

Another helpful hint is stated in Sentence 7.5.7.2.(1): "The size of a branch vent, stack vent, vent stack or header shall be not less than the size of the vent pipe to which it is connected."

General principles in sizing vents are:

- Vent sizes increase as hydraulic load increases.
- Vent sizes increase as the length of the vent increases.

SIZE OF TRAPS VENTED

Individual and dual vents are based on the size of traps served (Table 7.5.7.1.) The length of the vent is not taken into consideration in sizing individual or dual vents. Please note that the minimum size of a vent pipe is 1¼ in.

Table 7.5.7.1.
Minimum Permitted Size of Vent Pipe and Maximum Trap Arm Based on Size of Trap

Size of Trap Served (inches)	Minimum Size of Vent Pipe (inches)	Maximum Trap Arm (m)
1¼	1¼	1.5
1½	1¼	1.5
2	1½	1.5
3	1½	1.8
4	1½	3.0
5	2	4.0
6	2	5.0
Column 1	2	3

You will also need to consult **Table 7.4.9.3.** to determine the **minimum size of fixture outlet pipes.** You may wish to copy this table from your code and keep it handy for all vent sizing exercises.

EXERCISE 10 -12

Size the following vent pipes.

1. An individual vent serving a domestic clothes washer.

____

____

Code Ref: ________________________________

2. A dual vent serving two water closets.

____

____

Code Ref: ________________________________

3. A dual vent serving a 2 in. trap and a 1 ½ in. trap.

____

____

Code Ref: ________________________________

STOP

SIZING CONTINUOUS VENTS AND BRANCH VENTS

Continuous vents and branch vents are sized based on two factors:

- The hydraulic load served by vent, and
- The maximum length of vent pipe.

The hydraulic load served by the vent is determined in the same way as you determined it for sizing drainage pipes – from Table 7.4.9.3. Hydraulic loads for fixtures that you will commonly see in a house are reprinted here.

Excerpts from Table 7.4.9.3.
Hydraulic Loads of Common Fixtures in a House

Fixture	Hydraulic Load, fixture units
Kitchen Sink	1 ½
Dishwasher	1
Lavatory	1 (with 1 ¼ in. trap)
	1 ½ (with 1 ½ in. trap)
Bathtub or Shower	1 ½
Water Closet with flush tank	4
Clothes washer	1 ½ (with 1 ½ in. trap)
Laundry Tray	1 ½
Floor Drain (not located in a washroom)	2 (with 2 in. trap)
	3 (with 3 in. trap)
Bathroom Group (W/C flush tank, lavatory, bath or shower)	6

Note: Refer to the table in the Code for the official version.

To **determine the hydraulic load**, add the fixture units of the fixtures served by the vent. For example, if a branch vent serves a single laundry tray, a lavatory (1 ¼ in. trap) and a kitchen sink, it will serve a hydraulic load of 1 ½ + 1 + 1 ½ = 4.

The next factor to consider is the **length of the vent pipe**. For houses, this length will be limited, but still must be considered. Generally, vertical pipes through one storey will have a length of approximately 2.5 metres (about 8 feet).

Sentences 7.5.8.3.(2) and (5) state how the length of the branch vent and continuous vent are determined. The term **developed length** is used which simply means the centreline length of the pipe and fittings.

The developed length for a **branch vent** is the developed length of vent piping from the most distant soil or waste pipe connection to a vent stack, stack vent, header, or the open air.

Consult Table 7.5.8.3. to find the size of branch vent or continuous vent. For example, a continuous vent that serves 4 fixture units and has a length of 7 metres will need to be 1 ¼ in. size.

Note: You will quickly see from this table that you will rarely require a branch vent or continuous vent serving a typical house to be larger than 1 ¼ in. or 1 ½ in. **But remember that these vent pipes cannot be a smaller size than the vent pipes they are connected to.**

STOP

SIZING WET VENTS AND CONTINUOUS VENTS SERVING WET VENTS

You have already been introduced to the concept of a **wet vent** (i.e. a waste pipe that also serves as a vent pipe) and the conditions when wet venting is permitted (see Article 7.5.2.1.). The hydraulic load drained by a wet vent will determine the pipe size.

The following rules apply when calculating the required size of a **wet vent**:

- The hydraulic load of the most downstream fixture is not included.

  (This is because the waste drained from this fixture will not interfere with the venting function of the wet vent since it is downstream.)

- The hydraulic load of separately vented fixtures that drain to the wet vent need to be included.

  (This is because the waste drained from any fixture connected to the wet vent may interfere with the drainage or venting function of the wet vent, even though this other fixture does not require venting through the wet vent itself.)

A **continuous vent** or **stack vent** that serves a wet vent needs to be sized only for the hydraulic load that is wet vented. This is because a separately vented fixture will need the wet vent for drainage capacity, but not for venting capacity.

Minimum sizes of vent pipes are in Subsection 7.5.7.

The vent pipe sizes in Table 7.5.7.1. that are based on the size of trap served take precedence over all other venting tables.

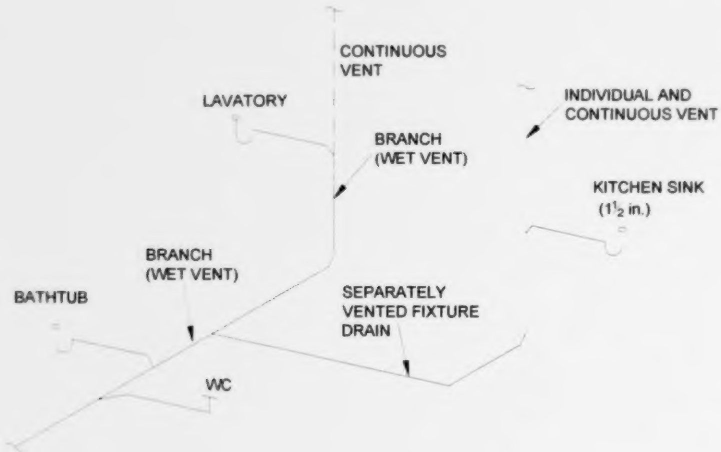
Example of Sizing a Wet Vent and a Continuous Vent Serving a Wet Vent

Figure 10:17 shows a water closet and a bathtub that are wet vented by a lavatory. A separately vented kitchen sink is also drained by the wet vent.

Calculate the size of the wet vent and the continuous vent serving the wet vent. The continuous vent is 3 metres long.

It is recommended that you highlight the sections of the drainage pipes that are used as wet vents.

Figure 10:17 Sizing a Wet Vent and a Continuous Vent



Note: Lavatories have 1 1/4 " traps.

Step 1. Determine the hydraulic loads of each fixture.

Find these from Table 7.4.9.3.

Lavatory Basin	1 fixture unit
Kitchen Sink	1.5 fixture units
Bathtub	1.5 fixture units
WC (flush tank)	4 fixture units

Step 2. Determine the hydraulic load carried by the wet vent.

The wet vent does not drain the water closet, so this is not included in the calculation, as per Sentence 7.5.8.1.(2).

Wet vent hydraulic load = lavatory + kitchen sink + bathtub = 4 fixture units

Step 3. Size the wet vent.

From Table 7.5.8.1., the wet vent is serving a water closet, so Column 3 is used. Since the hydraulic load is 4 fixture units, the wet vent pipe size is 3 in. As per 7.5.2.1.(1)(j), the wet vent size needs to be maintained throughout its entire length.

Step 4. Determine the hydraulic load served by the continuous vent.

Use only the hydraulic load that is wet vented as per Clause 7.5.2.1.(1)(g). The kitchen sink is separately vented, and is not included in the calculation.

Continuous vent hydraulic load = lavatory + bathtub + flush tank WC = 6.5 fixture units

But, this can be considered a **bathroom group** in Table 7.4.9.3, with a hydraulic load of 6 fixture units.

Step 5. Size the continuous vent.

From Table 7.5.8.3., a hydraulic load of 6 fixture units and a length of 3 metres will be adequately served by a 1 ¼ in. vent pipe.

However, consider that the wet vent serves a water closet with a 3 in. trap. As per Table 7.5.7.1., a 3 in. size trap requires a minimum vent size of 1 ½ in. Therefore, the continuous vent is required to be 1 ½ in. size.

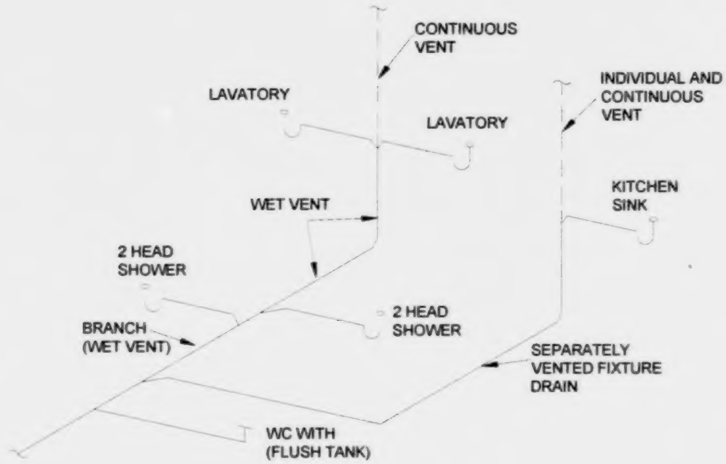
Note that the branch drain downstream of the wet vent is sized based on the hydraulic load served. The lavatory, bathtub and water closet can be considered as a bathroom group for Table 7.4.9.3. Branch hydraulic load = bathroom group + kitchen sink = 7.5 fixture units. The minimum size for this pipe is 3 inches based on Table 7.4.10.8., which matches the minimum drain size serving a water closet of 3 in (7.4.9.2.)

STOP

EXERCISE 10-13

Calculate the size of the wet vent and the continuous vent serving the wet vent in the Figure 10:18. The continuous vent is 4 metres long. The lavatories have 1 ¼ in. traps.

Figure 10:18 Sizing a Wet Vent and Continuous Vent (Ex.10-13)



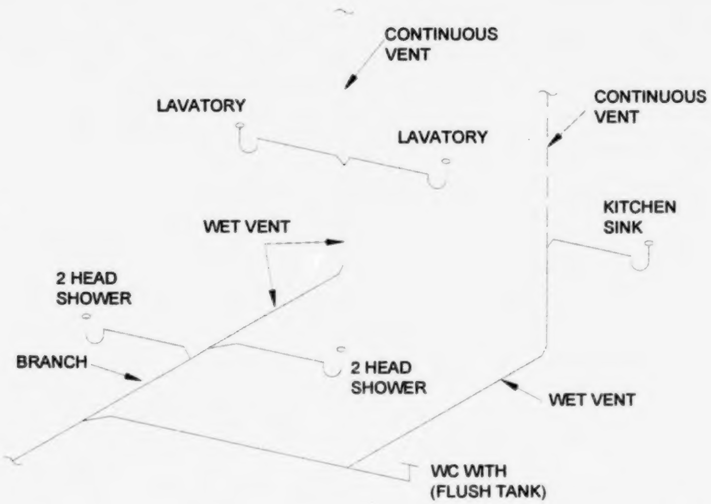
Code Ref: ______________________

STOP

EXERCISE 10-14

Calculate the size of the wet vent and the continuous vent serving the wet vent in the Figure 10:18. The continuous vent is 4 metres long. The lavatories have 1 ¼ in. traps.

Figure 10:19 Sizing a Wet Vent and Continuous Vent (Ex.10-14)



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Code Ref: ________________________________

STOP

SIZING VENT STACKS AND STACK VENTS

Knowing how to size vent stacks is not essential to this course because you will not normally find vent stacks in houses.

Stack vents in houses are typically 3 inches in order to satisfy the requirements of Sentences 7.5.7.2.(2) and (3), and Sentence 7.5.8.4.(5). The sentences require every sanitary building drain to terminate at its upstream end in a stack at least 3 in. in size.

Read the definition of **sanitary building drain** in Division A.

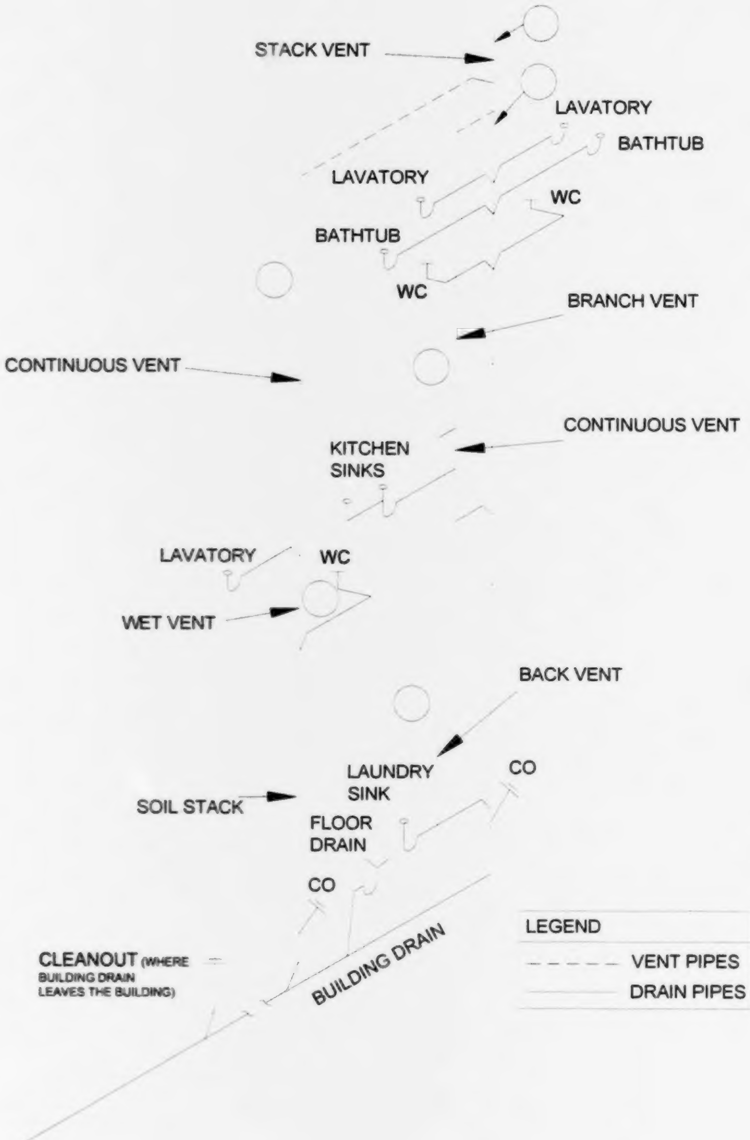
A 3 inch stack vent will adequately serve the hydraulic load of a typical house, so you do not need to use Table 7.5.8.4. for plumbing inspection of most houses that are 3 storeys or less.

<u>EXERCISE 10-15</u>

In your groups, use Subsections 7.5.7. and 7.5.8. to indicate the sizing for all the vent pipes on the diagram of the MITEC house on Figure 10:20. Include Code references.

Lavatories have 1 ¼" traps. The branch vent and continuous vent are 7 and 9 metres long respectively.

Figure 10:20 Sizing the Vents in the MITEC House - Exercise 10-15



STOP

SLOPE

Sentence 7.5.6.1.(1) of the OBC states that, "every vent pipe shall be installed without depression in which moisture can collect ". It is important that the grading of vent pipes can allow any accumulation of water to be drained, otherwise airflow through vent pipes would be restricted and the effectiveness of a venting system will then be reduced. The direction of the slope is not important, as long as

CONNECTIONS

The Ontario Building Code sets out specific requirements for the connection of sanitary drainage pipes to vent pipes. You will find these in Clauses 7.4.2.1.(1)(e), (f) and (g).

These Clauses deal with yoke vents, circuit vents and vent stacks, which are not commonly found in single-family dwellings.

JOINTS

In Subsection 7.3.3., "Joints and Connections," one Sentence specifically regulates the joints that connect vent piping.

Sentence 7.3.3.4.(2) states that a **slip joint** cannot be used in a venting system or drainage system, except to connect a fixture trap to a fixture drain in an accessible location.

EXERCISE 10-16

Think about why the Code has included this regulation and note your reason below. Discuss the problem with your group and write an answer on the flipchart.

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Code Ref: ______________________________________

STOP

THE ARRANGEMENT OF VENT PIPES

The upper end of every vent pipe is required to be above the flood level of the highest fixture it serves, before it can be connected to another vent pipe.

No vent piping may be arranged such that it would serve as a by-pass in the event of an obstruction in the drainage pipe.

Figure 10:20 shows how vent piping in the MITEC house is connected above the flood level of the highest fixture it serves.

These two regulations can be found in Article 7.5.6.4. of the OBC. Their contravention would threaten the health and safety of the inhabitants of any dwelling in which either case occurred.

Sewage might enter the vent pipe and block the passage of gases to the open air.

SUPPORT

Subsection 7.3.4. looks at the requirements for the support of piping. You should already be familiar with Section 7.3.; but if you need to, take a few minutes to look it over again. You will need to know this to be able to answer the following questions.

EXERCISE 10-17

Take five minutes to answer the following questions. Work by yourself.

1. Much of the venting system takes the form of vertical piping. In anchoring vertical piping, what must you remember?

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Code Ref: ______________________________

2. If the nominally horizontal vent-pipe material you are using is plastic, what is the necessary support interval?

Code Ref:

3. What must you remember to inspect for, when you are looking at the supports for plastic piping?

Code Ref:

4. What support is necessary for the vent terminal?

Code Ref:

STOP

CUTTING AND NOTCHING OF JOISTS

Often, the support for venting pipes will involve the cutting and notching of joists. Incorrect notching may have some impact on the plumbing system.

For example, the joist might have been notched too small, causing venting pipes to bow when they expand. On the other hand, if joists are notched too much they may cause a structural problem, and will have to be corrected.

If this happens after the plumbing has been inspected, the correction may result in changes to the plumbing that could contravene Subsection 9.23.5. of the Ontario Building Code. These contraventions may not necessarily be caught.

The following is a guide for plumbing inspectors for the acceptable methods of cutting and notching joists. See Figure 10:21 for illustrations.

The corresponding references of the Ontario Building Code are noted after each point. The actual wording of the relevant requirements can be found in Division B, Section 9.23.
Holes in floor, roof and ceiling frame members must not exceed one-quarter of the depth of the member, nor be located less than 50 mm from any edge, unless the depth of the member is increased by the size of the hole—Article 9.23.5.1.

Floor, roof and ceiling members may be notched if the notch is located on the top within half the joist depth from the edge, and is not deeper than one-third of the depth, unless the depth of the member is increased by the size of the notch—Article 9.23.5.2.

Holes in studs must be no more than one-third the width of the stud, if the stud is load bearing. If the stud is not load bearing, the undamaged portion must be at least 40 mm wide—Article 9.23.5.3.

Top plates in load bearing walls and partitions cannot be notched or drilled so that the undamaged width is less than 50 mm, unless the weakened plates are suitably reinforced—Article 9.23.5.4.

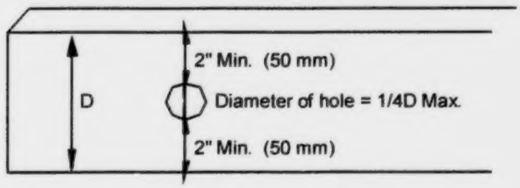
Roof-truss members must not be notched or drilled unless it was allowed for in the design of the truss—Article 9.23.5.5.

Columns and double studs required to support a lintel or beam cannot be drilled.

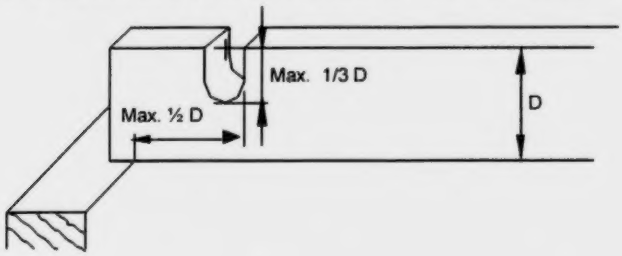
STOP

Figure 10:21 CUTTING AND NOTCHING OF JOISTS

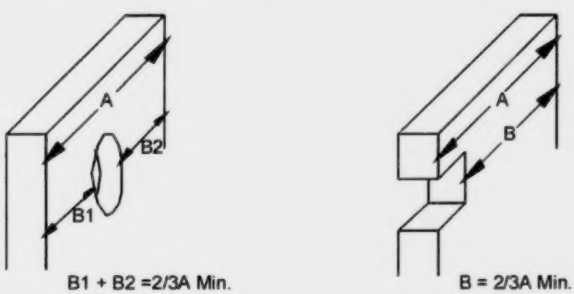
HOLES IN FLOOR, ROOF OR CEILING FRAMING MEMBERS



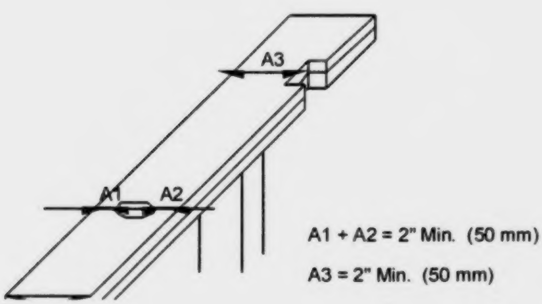
NOTCHES IN FLOOR, ROOF OR CEILING FRAMING MEMBERS



NOTCHES OR HOLES IN LOAD BEARING STUDS



TOP PLATES IN WALLS



OTHER ISSUES

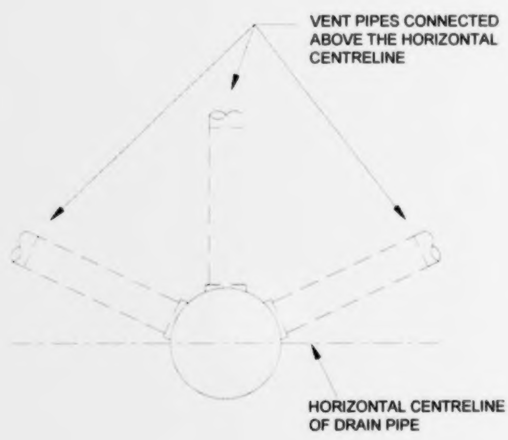
One of the objectives of this module is to allow you to become familiar with all of Section 7.5. of the Ontario Building Code. There are still some points that have not been covered.

The first is found in Article 7.5.6.2. Sentence 7.5.6.2.(1) describes the need to economize on piping and requires every vent pipe to be installed as directly as possible to a stack or to the open air.

It also stipulates that the horizontal run below the flood level of the fixture to which the vent pipe is installed should be eliminated where possible. This kind of situation might happen where a vent pipe needs to travel around a large beam or other structural member near the fixture before going up.

Where vent pipes are connected to nominally horizontal soil or waste pipes, Sentence 7.5.6.2.(2) requires the connections to be above the horizontal centre line of the waste or soil pipe, unless they are wet vents. Figure 10:22 illustrates how vent pipes are to be connected.

Figure 10:22 Vent Pipe Connections

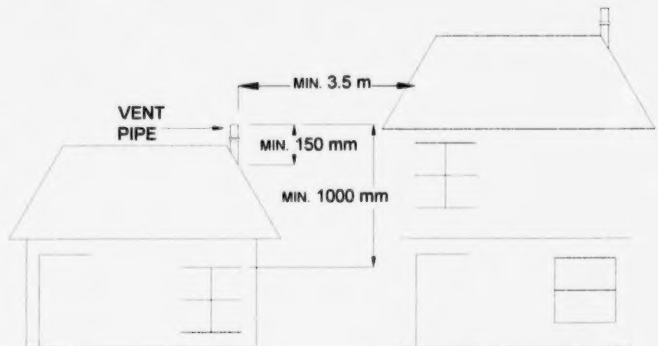


STOP

THE VENT TERMINAL

The venting system ends in a vent terminal, which extends through the roof or exterior wall. Article 7.5.6.5. of the Code sets out requirements for the length and location of this pipe.

Figure 10:23 Vent Terminal Location



Every building drain must be connected to a stack at least 3" in size going to the open air above the roof. This requirement from Article 7.5.7.2. tells you that every vent terminal must be 3" in diameter.

In addition, Sentence 7.5.6.5.(3) states that where a vent pipe passes through a roof or an outside wall of a building, it must be increased to a minimum size of 3" before penetrating the roof or wall.

The flashing materials for piping that penetrates an exterior wall or roof must conform to certain standards; these are set out in Article 7.2.10.14.

The Code is very specific about the minimum thickness for each type of metal that can be used for flashing. If the flashing is too thin, it may be damaged or destroyed by high winds. Also, the flashing must be of adequate thickness to seal the connection properly through the years of exposed conditions.

STOP

FRESH-AIR INLETS AND BUILDING TRAPS

Article 7.5.5.4. sets out the requirements for venting building traps. Building traps are typically installed only in older homes, and you likely won't see one as it is usually below the basement floor.

Where building traps are installed, the OBC has a requirement that a fresh air inlet be installed on the upstream side within 1200 mm – Sentence 7.5.5.4.(1).

There is also a requirement in Article 7.4.5.4. for cleanouts to serve the building trap.

VENTS FOR SANITARY SEWAGE SUMPS OR TANKS

Articles 7.5.5.1. and 7.5.7.7. of the OBC set out the requirements for venting of sanitary sewage sumps. Read these Articles now and complete the following exercise.

EXERCISE 10-18

What size must the vent pipe be if a 4" drain goes into a sanitary sewage tank? Where must the vent pipe be connected?

____

____

Code Ref: ____________________________________

STOP

AIR ADMITTANCE VALVES

You may see air admittance valves when a basement is being renovated and a new washroom being installed.

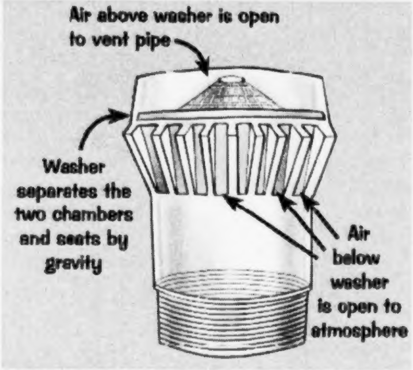
An air admittance valve provides a venting function through a one-way valve designed to allow air to enter the drainage system when the pressure in the plumbing system is less than the atmospheric pressure.

The 2006 OBC **permits air admittance valves** to be used to vent fixtures in **buildings undergoing renovation** and where the **connection to a vent may not be practical**. Both of these conditions are necessary for air admittance valves to be permitted. Air admittance valves cannot be used in new construction.

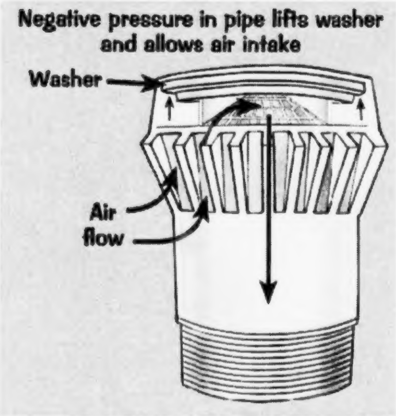
Subsection 7.5.9 sets out additional conditions where air admittance valves can and cannot be used, and requirements for their installation.

Air admittance valves must conform to ASSE 1051, "Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems" – Sentence 7.2.10.16.(1)

Figure 10:24 Air Admittance Valves



Air Admittance Valve in Closed Position



Operation of Air Admittance Valve

STOP

COMMON DEFICIENCIES IN THE VENTING SYSTEM

There are many potential problems in installing the venting system. Just about everything regulated in the Code can be contravened. Much depends on the caliber of the plumbing contractors you are dealing with.

Some of the more common problems you are likely to encounter are:

- **Bowing of pipes** because of inadequate expansion holes in joists and studs
- **Incorrect sizing** of vent pipes because of failure to include the floor drain as a fixture to be vented
- **Incorrect installation** of the vent terminal; e.g., too close to a window, or covered over after rough-in inspection

Within your groups, come up with more items to add to this list of common deficiencies. Write your list on the flipchart, developing as many items as possible in the next 10 minutes.

Use examples from your own experiences and be prepared to explain your responses. Note your results in the following space for your future reference.

<u>EXERCISE 10-19</u>: Common Deficiencies in the Venting System

STOP

TESTING

Subsection 7.3.6. lists the requirements for the testing of the drainage and venting systems. According to this Subsection, the only **three common tests** that should be performed on the venting system are:

- The water test
- The air test
- The final test

The first two tests basically perform the same function: they are primarily used to test the venting system for leaks at the rough-in stage. It is not necessary to do both tests.

In fact, an air test should be done only when the water test cannot be carried out. A final test is carried out only where the local Chief Building Official requires it.

Typically the drainage and venting systems are tested at the same time.

EXERCISE 10-20: The Air Test

Get together with your group. On the flipchart, write an explanation of how to conduct an air test on the venting system. You have five minutes.

STOP

DOCUMENTATION

At the end of this inspection it is important to write an inspection report or field notes, which contain at least the following information:

- Date and time of inspection
- The name of the contractor or permit-holder requesting the inspection
- The name of the person you saw
- The address of the building being inspected
- Any problems or potential problems
- Any progress on past problems

As you go through the inspection, make notes on your inspection checklist, which can be used in completing the inspection report later. This way you will avoid making mistakes by relying on your memory.

Many inspectors make it a habit to write their inspection reports in their cars immediately after they have completed the inspection. Do this before pulling out into traffic!

It is very important to do this paperwork as soon as possible, so that the documentation will be accurate. People generally have pretty good recall for up to 12 hours; but after that, accuracy starts to fade.

Think of the report as the last step in the inspection, and try to complete it as soon as you get back to the office.

EXERCISE 10-21: Down the Drain Does It Again

You have just finished inspecting a drainage and venting installation put in by your favourite contractor, Down the Drain Inc. Every time you inspect Down the Drain's work, you find another violation of the Code. You are beginning to suspect that this is being done on purpose!

During today's inspection of stacks, wastes and venting in the MITEC house, you noted these items:

- During the water test, there were leaks in the connection of the WC soil pipes to the stack on the second floor.
- The vent terminal was in the attic.

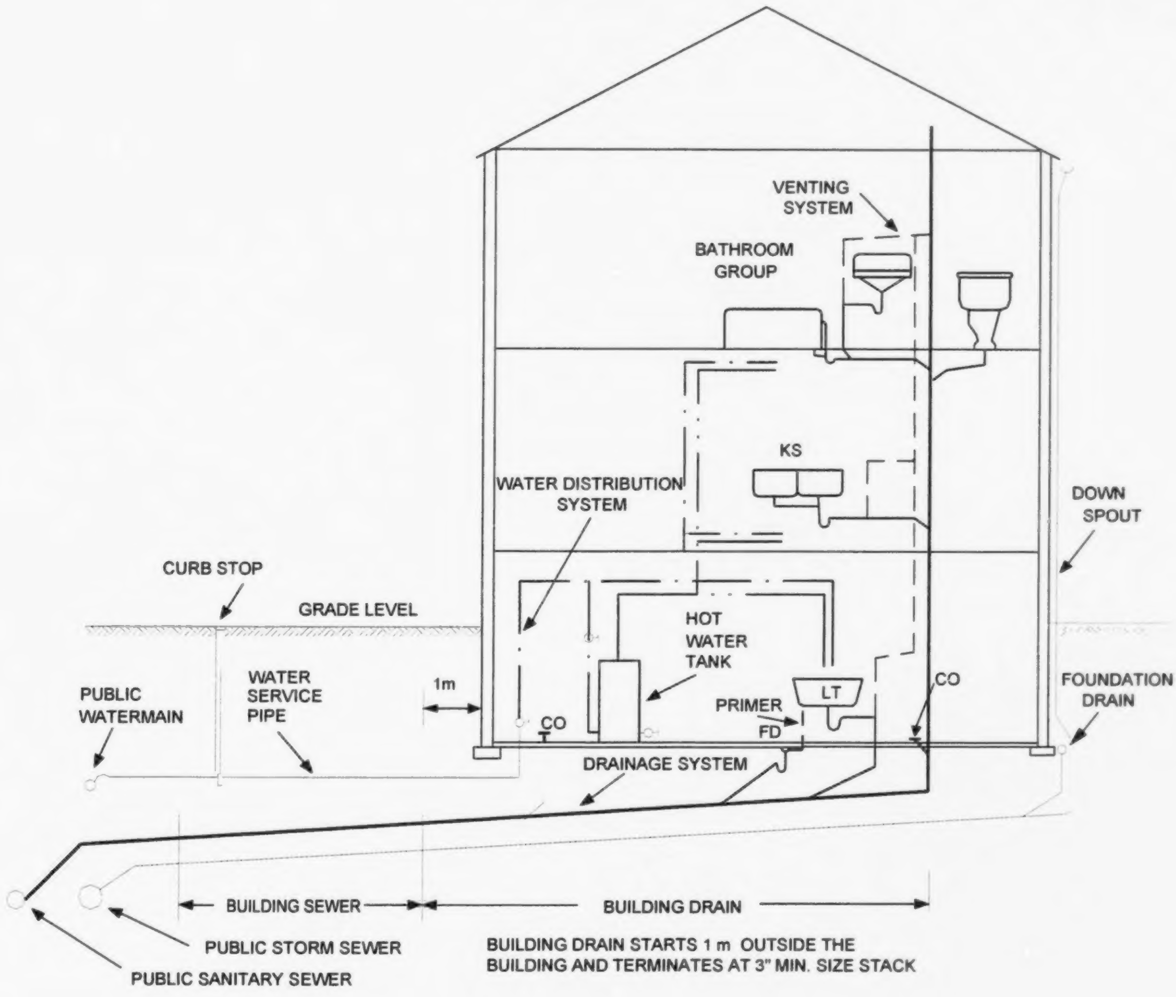
You also made a sketch of the drainage and venting systems as Down the Drain had built them.

Using the notes above and Figure 10:25, determine which sections of the Code have been violated and write a report on the inspection.

Inspection Report

STOP

Figure 10:25 DOWN THE DRAIN'S DWV SYSTEM



EXERCISE 10-22: Checklist Exercise

In your group, take the next 10 minutes to come up with a checklist that would help you to inspect both the venting system and the waste pipes and stacks. Make sure that you indicate on this checklist the sections of the Code that you will need to reference.

Write the checklist on the flipchart. Make the checklist easy to use—don't just rewrite the regulations contained in the Ontario Building Code

STOP

MODULE 10 QUIZ

1. It is necessary to provide a vent system because vent pipes:

   a) Help you minimize the number of drainage pipes used
   b) Help increase the pressure in traps
   c) Protect trap seals by maintaining atmospheric pressure in the drainage system
   d) Ensure proper pressure in distributing pipes

   Code Ref: ____________________

2. Which of the following is NOT part of the venting system?

   a) Fresh air inlet
   b) Wet vent
   c) Cleanout
   d) Header

   Code Ref: ____________________

3. The different types of copper tubing may or may not be acceptable, depending on where in the plumbing system they are. Which of the following materials is NOT permitted for use in above-ground vent pipes?

   a) K hard copper tubing
   b) L hard copper tubing
   c) M soft copper tubing
   d) DWV copper tubing

   Code Ref: ____________________

4. What is the minimum size of the vent that serves the designated sanitary building drain?

   a) 1½"
   b) 2"
   c) 2½"
   d) 3"

   Code Ref: ____________________

5. The maximum length in metres for a 1¼" branch vent pipe serving 6 fixture units is:

   a) 2 metres
   b) 9 metres
   c) 7.5 metres
   d) 8 metres

   Code Ref: ____________________

6. Branch vents are sized according to the:

   a) number of water closets vented
   b) size of the traps vented
   c) developed length and hydraulic load served
   d) hydraulic load served

   Code Ref: ____________________

7. Every storey of a building, including a basement of a single family dwelling requires:

   a) At least one 1½" vent pipe for a future connection
   b) At least one 2" vent pipe
   c) A vent pipe large enough to vent one water closet
   d) A vent pipe made of copper tubing

   Code Ref: ____________________

8. A pipe that vents a 1 ½ in. fixture trap must be located so that the developed length of the trap arm is:

   a) Not less than twice the size of the fixture drain
   b) Not over 1.2 m
   c) Not over twice the size of the fixture drain
   d) 1.5 m

   Code Ref: ________________

9. Horizontal ABS or PVC plastic vent pipes must be supported every:

   a) 1.2 metres
   b) 1.5 metres
   c) 1.8 metres
   d) 2.2 metres

   Code Ref: ________________

10. Which of the following statements about the arrangements of vent pipes is NOT true?

   a) No vent piping shall be so arranged that it will serve as a by-pass in the event of an obstruction in the drainage pipe
   b) The upper end of every vent pipe shall be above the flood level of the highest fixture it serves before connection to another vent pipe
   c) Except for wet vents, vent pipes are required to be connected below the horizontal centreline of a horizontal pipe
   d) Vent pipes shall be as direct as possible to a vent stack or open air

   Code Ref: ________________

11. Which of the following tests would NOT be performed on a venting system?

    a) The ball test
    b) The air test
    c) The water test
    d) The final test

    Code Ref: ____________________

12. A vent stack is required in:

    a) All buildings
    b) All houses
    c) Buildings greater than 3 storeys in height
    d) Buildings greater than 4 storeys in height

    Code Ref: ____________________

13. Every vent pipe must be:

    a) Provided with flashing.
    b) Installed to connect as directly as possible to a vent stack
    c) Made of inflammable material
    d) Connected to a horizontal run of pipe

    Code Ref: ____________________

14. ABS stands for:

    a) American Building Standards
    b) Acrylic butane styrofoam
    c) Acrylonitrile butadiene styrene
    d) Artium baccalaureus et scientiae

    Code Ref: ____________________

15. Where there is a building trap, a fresh air inlet must be connected:

    a) Downstream of the building trap and upstream of other connections
    b) Downstream of the building trap
    c) Upstream of any other connections
    d) Upstream of the trap and downstream of other connections

    Code Ref: ____________________

16. A wet vent is a:

    a) Vent pipe that leaks during a water test
    b) Waste pipe that also serves as a vent pipe
    c) Vent pipe that is full of water
    d) Vent pipe that runs underground

    Code Ref: ____________________

17. The maximum length of a wet vent is:

    a) 9 metres
    b) 18 metres
    c) One storey
    d) Length is not limited

    Code Ref: ________________

18. The maximum number of water closets that can be wet vented is:

    a) 0
    b) 1
    c) 2
    d) 3

    Code Ref: ________________

19. The maximum hydraulic load that can be served by a 3 inch wet vent that also serves water closets is:

    a) 4
    b) 8
    c) 12
    d) 14

    Code Ref: ________________

20. A trap serving a floor drain would need to be protected by a vent pipe if the trap:

    a) connected to a drain pipe vented by a 2 in. stack
    b) connected to a drain pipe vented by a 3 in. stack
    c) was 3 in. in size
    d) was 4 in. in size

    Code Ref: ________________

END OF MODULE 10

MODULE 11

FIXTURES AND PLUMBING APPLIANCES INSPECTION

PLUMBING - HOUSE - 2007

MODULE CONTENTS Page

LEARNING OBJECTIVES

Upon completion of this module, participants will be able to:

- Plan and carry out a final inspection.
- List some problems commonly found in the installation of fixtures and plumbing appliances.
- Define terms specific to fixtures and plumbing appliances.
- Identify compliance and noncompliance in the installation of fixtures and plumbing appliances.

INTRODUCTION

This is the final inspection, performed when the house is finished or almost finished. Although you are there to inspect the installation of the fixtures and plumbing appliances, this is also the time for you to inspect the entire operation of the plumbing system.

If you have done each inspection up to now and found the plumbing to be in compliance with the Code, then the last inspection phase may well be only a verification of the number or location of the fixtures and plumbing appliances indicated on the permit application.

However, there may be several months between the last rough-framing inspection and the final inspection. During this time, much can happen to affect the plumbing system:

- Contraventions to other parts of the Ontario Building Code may result in repairs that alter the plumbing.
- Last-minute changes, such as the addition or deletion of an extra fixture or plumbing appliance, can affect the loading on drains.

For this reason, the final inspection is often more than an inspection of the installation of fixtures and plumbing appliances.

For the purposes of this course, however, we are assuming that all other aspects of the plumbing system have been checked during prior inspections and that no further changes have been made that affect the plumbing system. This module will therefore focus only on fixtures and plumbing appliances.

THE DIFFERENCE BETWEEN A FIXTURE AND A PLUMBING APPLIANCE

A **fixture** is a receptacle, plumbing appliance, apparatus or other device that discharges sewage or clear-water waste, and includes a floor drain.

A **plumbing appliance** is a receptacle or equipment that receives or collects water, liquids or sewage, and discharges water, liquid or sewage directly or indirectly to a plumbing system.

These definitions are contained in the Ontario Building Code. Remember that a plumbing appliance, unlike a fixture, is permitted to discharge waste either directly or indirectly into a plumbing system. A sink is an example of a fixture; a washing machine is an example of a plumbing appliance.

According to Sentence 7.4.2.1.(1) of the Code, every fixture must be directly connected to a sanitary drainage system, except as permitted in the Clauses contained in Sentence 7.4.2.1.(1).

STOP

MINIMUM REQUIREMENTS FOR A SINGLE-FAMILY DWELLING

EXERCISE 11-1

Take a few minutes to answers the following questions with your group. Write your responses on the flipcharts.

1. There is a minimum requirement for fixtures in a house. Can you list what these fixtures are? (Remember that this requirement is stipulated in Division B Section 9.31., and not in Part 7 of the Ontario Building Code.)

   ____

   ____

   ____

   Code Ref:________________________________

2. What other fixtures or plumbing appliances are commonly found in the single-family dwelling?

   ____

   ____

   ____

   Code Ref:________________________________

STOP

PREPARATION FOR INSPECTION

The final inspection is the most critical, as it is your last chance to catch any contraventions of the Code before the plumbing permit is being signed off. It is important to plan this inspection carefully.

EXERCISE 11-2

Take the next few minutes to discuss with your groups the types of things you should be concerned about and how you would prepare for the final inspection.

How I would prepare for the final inspection:

STOP

COMMON TERMS USED IN A PLUMBING SYSTEM

EXERCISE 11-3

The following is a list of terms that we have encountered on a daily basis. Make sure you understand the difference between fixtures and plumbing appliances and can tell which of the following terms relates to **fixtures** and which to **plumbing appliances**.

1.	Washing machine	7.	Fixture unit
2.	Water closet	8.	Flush valve
3.	Sink	9.	Bathtub
4.	Floor drain	10.	Trap
5.	Wash basin	11.	Flood level rim
6.	Fixture outlet pipe	12.	Service water heater

Work within your group. Each person will be responsible for understanding two or three terms. Write your working definitions for these terms on your flipchart. Have one person act as scribe, and the rest of the group tell this person what to write.

Notes

STOP

SITE CONDITIONS

Being able to get at what you are going to inspect is the most critical issue with site conditions for the final inspection. This should not be a problem when it comes to inspecting fixtures, but be careful. (Refer to Article 7.1.6.2. of the Code.)

It is important when inspecting fittings to be able to see the certification markings; installations must be done taking this into consideration. If the marking is not visible, **the fittings are assumed not to be certified** and therefore in contravention of the Code.

IDENTIFICATION AND CERTIFICATION

Article 7.2.1.3. states the following:

- Every length of pipe and every fitting shall have cast, stamped or indelibly marked on it **the maker's name or mark** and the weight or class or quality of the product, or it shall be marked in accordance with the relevant standard, and such markings shall be visible after installation.

- Where a component of a plumbing system is required by this Code to comply with a standard and the compliance is not certified by a testing agency accredited by the Standards Council of Canada for the testing of the component in question and, when an inspector requests proof of the compliance, **proof of compliance shall be produced** by the person proposing to install or have installed the permanent part of any plumbing system.

- The **lack of certification markings** on a product or plumbing component shall be regarded as proof, in the absence of evidence to the contrary that **no certification exists**.
- If a component of a plumbing system is required to be certified to a standard, **the certification shall be made by a testing agency** accredited for that purpose by the Standards Council of Canada.

Furthermore, Article 7.2.1.2. of the Code states used material shall not be reused unless they meet the requirements for new material and are satisfactory for their intended use.

In addition, please review Division B, Section 1.3. of OBC.

EXERCISE 11-4

What does this mean and what impact does it have on all the specified standards? Discuss this with your group and write down the requirements below.

____

____

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____

____

STOP

SURFACE REQUIREMENTS FOR FIXTURES

Except for area designed to be slip proof in such fixtures, Article 7.2.2.1 of the Code requires every exposed area of a fixture to have a smooth, hard, corrosion-resistant surface free from flaws and blemishes that may interfere with cleaning.

EXERCISE 11-5

You should read Subsection 7.2.2. through now to prepare yourself for the questions that follow. Be aware that not all of this Subsection is relevant to this course, because it includes issues not pertinent to the single-family dwelling.

1. What is the requirement for the surfaces of wall and floor surrounding a shower receptor?

   ____

   ____

   ____

   Code Ref: ________________________________

2. How many shower heads may be served by a single drain?

   ____

   ____

   Code Ref: ________________________________

3. Where is a concealed overflow not permitted in a fixture?

   ____

   ____

   Code Ref: ________________________________

4. What kind of urinal is not permitted to be installed in a plumbing system?

____

____

Code Ref: ________________________________

STOP

WATER SUPPLY IN A PLUMBING SYSTEM

Article 7.2.10.6. of the Ontario Building Code is relevant to supply and waste fittings in a plumbing system. This Article states that supply and waste fittings shall be certified to Standard CAN/CSA B125, Plumbing Fittings.

Furthermore, Subsection 7.6.4. of the Code regulates water efficiency of supply fittings and the amount of water required to flush per cycle for fixtures.

<u>EXERCISE 11-6</u>

Read Subsection 7.6.4. of the Code and answer the following questions:

1. What is the maximum required water flow rate for lavatory and kitchen faucets?

____

____

Code Ref: ________________________________

2. What is the maximum flush cycle for a replacement-tank–type water closet after the first day of January 1996, if the building was built before January 1, 1996?

____

____

Code Ref: ________________________________

3. a) What is the Standard a water closet or a urinal must be certified to?

____

____

Code Ref: ________________________________

b) Are there any exceptions?

____

____

Code Ref: ________________________________

4. What kind of fixtures are not required to meet the flush-cycle criteria?

____

____

Code Ref: ________________________________

STOP

SIZE OF FIXTURE OUTLET PIPES

The size of fixtures and plumbing appliances is not specifically regulated; however, the size of the fixture outlet pipes that service them is regulated.

EXERCISE 11-7

You saw Table 7.4.9.3. when you were doing the module on stacks and wastes. This Table is a part of Article 7.4.9.3., which states that the size of every fixture outlet pipe must conform to Table 7.4.9.3. Take a minute to look at this Table now.

Similarly, the size of the supply pipes is regulated by the type of fixture they service. This is covered in Table 7.6.3.1., which you should also look at to refresh your memory.

From the information in those two Tables, complete the following chart for the minimum required pipe sizing for the fixtures in a single-family dwelling.

Size of Fixture Outlet Pipe and Supply Pipe
(Refer to Table 7.4.9.3 and Table 7.6.3.1)

Fixtures	Size of Fixture Outlet Pipe	Size of Supply pipe
Water Closet with Flush Tank		
Lavatory		
Bathtub		
Domestic Sink		
Laundry Tray		

STOP

LOADING

You do not have to worry about loading on fixtures and plumbing appliances, but you do have to be concerned with the loading of the waste pipes the fixtures and plumbing appliances empty into. This material was covered in Module Two and in the "Water Supply and Waste Disposal" course.

SLOPE AND LENGTH

For obvious reasons, slope and length are not relevant to fixtures and plumbing appliances. However, the fixture drains and vents must be checked for compliance to the Code.

CONNECTIONS

Fixtures are connected to both the drainage system and the supply system. These connections have already been covered in Modules Two and Four.

CONNECTIONS TO BOILERS

Sentence 7.6.2.2.(2) of the Code states that where a potable water supply is connected to any device (e.g., a boiler, tank, cooling jacket, or lawn sprinkler system) where a non-potable fluid may be under pressure above atmospheric pressure or where the water outlet may be submerged in a non-potable fluid, the water supply must be protected against backflow by a backflow preventer.

EXERCISE 11-8

In your group, discuss the following questions and this regulation briefly. Take the time to read it in the Code.

1. Is a boiler a fixture or a plumbing appliance?

____

____

2. Why is it necessary to have a backflow preventer on the water supply to a boiler?

____

____

3. What type of backflow might occur?

____

____

STOP

SUPPORT OF PIPING

Piping, fixtures, tanks, or devices must be supported independently of each other—Article 7.3.4.2.

Article 7.3.4.1. of the Code also sets out requirements on the capability of support in terms of the fixtures and piping:

- Piping shall be provided with support that is capable of keeping the pipe in alignment and bearing the weight of the pipe and its contents.
- Every floor- or wall-mounted water-closet bowl shall be securely attached to the floor or wall by means of a flange and shall be stable.

- Every wall-mounted fixture shall be supported so that no strain is transmitted to the piping.

EXERCISE 11-9

What might happen if the requirements for support of piping or fixtures were not met? Take a few minutes to answer this question within your groups.

Why it is necessary to support a fixture with something other than the piping:

____

____

____

____

____

____

STOP

OTHER ISSUES

There are several important parts of the Code related to fixtures and plumbing appliances that have not been covered in any of the other checklist items. For examples, Subsections 7.1.6. and 7.4.3. of the Code regulate the location of fixtures, stipulating the following requirements:

- Plumbing fixtures **shall not be installed in a room** that is not lighted and ventilated—Article 7.1.6.1.

- Every fixture, plumbing appliance, interceptor, cleanout, valve, device or piece of equipment shall be so located that it is **readily accessible for use, cleaning and maintenance**—Sentence 7.1.6.2.(1).

- Sanitary units, bathtubs and shower baths shall not be installed **adjacent to wall and floor surfaces that are pervious to water**—Article 7.4.3.1.

- Indirect connections or any trap that may overflow shall not be located **in a crawl space or any other unfrequented area**—Article 7.4.3.2.

HOT-WATER TANKS OR SERVICE WATER HEATERS

Hot water must be supplied to every dwelling unit and must be 45°C to 60°C. This regulation appears in Article 9.31.6.1. The Code also establishes the standards for installing a hot-water tank.

Article 7.6.1.12. requires that hot-water tanks be fitted with a pressure relief valve and with a temperature relief valve. Often these valves are combined, and this is permitted in Sentence 7.6.1.12.(3), provided the conditions for each type of valve of each are met.

EXERCISE 11-10

Read through Article 7.6.1.12. and then discuss the following questions with your group.

1. Why is it necessary to have relief valves on hot-water tanks?

   ____

   ____

   ____

   ____

   Code Ref: ______________________________

2. How does a pressure-relief valve work?

   ____

   ____

   ____

   ____

3. How does a temperature-relief valve operate?

   ____

   ____

   ____

   ____

STOP

LOCATION OF FIXTURES AND THE DRAINAGE SYSTEM

As discussed previously, Subsection 7.4.3. regulates the location of fixtures as they relate to the drainage system. Traps for sanitary drainage systems are addressed in Subsection 7.4.5. of the Code.

The basic rule is that every fixture requires a trap as per Sentence 7.4.5.1.(1). However, for two or three-compartment sinks a single trap is permitted. Also, one trap is permitted to serve a group of floor drains if they are located in the same room and if they do not receive food or other organic waste, as per Sentence 7.4.5.1.(3).

The connection of domestic dishwashing machines to the fixture outlet pipe of an adjacent kitchen sink is addressed in Sentence 7.4.5.1.(6). The connection is required to be via a Y fitting on the inlet side of the sink trap, and it is required to rise as high as possible to just under the counter.

<u>EXERCISE 11-11</u>

Take the next few minutes to read through Subsections 7.4.3. and 7.4.5. to prepare yourself to answer the following questions with your group.

1.a) Why do we permit a trap to serve a group of floor drains?

____

____

b) Under what condition is this kind of installation permitted?

____

____

Code Ref: ____________________________________

2. Where must a garbage grinder be located with respect to an interceptor? Why?

____

____

Code Ref: ____________________________________

3. When a dishwasher pumps discharge to an adjacent kitchen sink, where and how is it required to connect to the sink fixture outlet pipe?

____

____

Code Ref: ____________________________________

STOP

COMMON DEFICIENCIES

There are many problems an inspector might find when inspecting the fixtures and plumbing appliances during the final inspection. Some of the more common ones are listed below:

- Imported brass fittings that are not certified to a Standard regulated in the Code
- Improper relief valves or no valves on the hot-water tank
- Use of clamps to connect humidifier or refrigerator to water supply

EXERCISE 11-12

In your groups, come up with a list of other deficiencies common to fixtures and plumbing appliances and their installation in single-family dwellings.

Common deficiencies with fixtures and plumbing appliances:

____

____

____

____

____

____

STOP

TESTING

This is the inspection where a final test may be used. The regulations for a final test can be found in Sentences 7.3.6.1.(2) and 7.3.6.6.(1) of the Code.

The final test checks for the following:

- Trap seals are airtight.
- Trap connections are airtight.
- Fixtures have been properly connected.

This test should be used after a water test or air test has been carried out.

When the plumber or contractor performs the final test, he or she must ensure that:

1) Every trap is filled with water
2) The bottom of the system being tested terminates at the building trap, test plug or cap
3) Smoke from smoke-generating machines is forced into the system (normally done through a cleanout at the base of a stack)
4) When the smoke appears from all roof terminals, they are closed
5) A pressure equivalent to a 25 mm water column is maintained for 15 minutes without the addition of more smoke

EXERCISE 11-13: Testing

Assume that you have just driven up to a property and you are about to start your final inspection. What would you do? With your group develop a list of steps to follow to complete the final inspection.

Step-by-step analysis of the final inspection:

STOP

FINAL ADMINISTRATIVE PROCEDURE

The objective of all of these inspections is to get to a stage where the plumbing has been installed in compliance with the Code. Signing off the plumbing permit takes place after the final inspection and is the final administrative task.

The following references are relevant to the administrative procedures contained in the Ontario Building Code Act.

Section 8(12) states that **no person may make a material change** or cause a material change to be made to a plan, specification, document or other information on the basis of which a permit was issued, without notifying, filing details with, and obtaining the authorization of the CBO.

Section 9 states that the chief building official (CBO) may (subject to conditions that may be set out in the building code) allow the use of **materials, systems and building designs not authorized in the building code** if, in his or her opinion, the proposed materials, systems and building designs will provide the level of performance required by the building code.

Section 11 requires that no person may **occupy or use** (or permit to be occupied or used) any building or part thereof newly erected or installed unless any order made by an inspector under Section 12 has been complied with.

An **emergency order** may be issued under Section 15.10 if it is deemed to be necessary.

Section 36(8) indicates that no proceeding under this section (the section of offence) may be commenced more than **one year after** the time when the subject matter of the proceeding arose.

INSPECTIONS FOR CONTAMINATION OF POTABLE WATER SUPPLY

Section 15.9(1) and (2) of the Ontario Building Code Act gives the municipality the power to make an order if the installation of plumbing may endanger the health or safety of any person.

EXERCISE 11-15

Why do you think it was necessary to give municipalities this additional authority? Discuss this with your group.

____

____

____

____

____

____

____

STOP

DOCUMENTATION

If the plumbing has been installed in compliance with the Code, this is the final report you will be required to write.

You should make a note of any particular points you were concerned with earlier and then note all the data which you included in your field notes:

- Date, time
- Site lot number
- Contractor
- Person conducting the tests
- etc.

If the plumbing is in compliance, this report will be brief.

FINAL REPORT—FINALLY!

The owner of "Down the Drain" has finally finished his plumbing installation in the MITEC house. He also claims to have altered all his previous infractions of the Code and has called you for a final inspection.

You complete your final inspection, witness a final test, and discover, to your relief and surprise, that the entire plumbing system complies with the Code.

Write your report on this final inspection.

STOP

MODULE REVIEW

During the next 10 minutes, review the text and your notes for this module. Write down the most important teaching points raised and then compare your notes with those of your classmates:

Major teaching points in this Module:

STOP

MODULE 11 QUIZ

1. The difference between a fixture and a plumbing appliance is:

   a) That an appliance is built into the system and a fixture can be added at any stage
   b) The difference between a water heater and a water softener
   c) The difference between a dishwasher and a washing machine
   d) That one receives and discharges water, liquid or sewage, and one discharges sewage or clear waste

   Code Ref: ________________

2. The minimum number of fixtures required for a single-family dwelling:

   a) Depends on the number of bedrooms in the dwelling
   b) Is regulated in Division B Part 7 of the Ontario Building Code
   c) Is a w.c., bathtub or shower, lavatory, kitchen sink, water closet, space for laundry facilities and a floor drain if a basement exists
   d) Is a w.c., bathtub or shower, lavatory, kitchen sink, and water closet

   Code Ref: ________________

3. A fixture unit is an assigned value that:

   a) Differentiates one fixture from another
   b) Helps assess the hydraulic load of a fixture
   c) Determine the weight of the fixture
   d) Is used to assess the size of vent necessary

   Code Ref: ________________

4. Which of the following is not a plumbing appliance?

   a) Garbage grinder
   b) Hot-water tank
   c) Dishwasher
   d) Bidet
   Code Ref: ___________________

5. All fixtures must be:

   a) Certified to a standard
   b) Corrosion resistant surface free from flaws
   c) Not made of concrete
   d) Made of stainless steel, porcelain, vitreous china or plastic
   Code Ref: ___________________

6. All supply and waste fittings must be certified to the Standard of

   a) CAN/CSA-B45
   b) CAN/CSA-B64
   c) CAN/CSA-B125
   d) CAN/CSA-B272
   Code Ref: ___________________

7. Which of the following does not require a 1-1/2" fixture outlet pipe and a 1/2" supply pipe?

   a) Wash basin
   b) Bathtub
   c) Laundry tub
   d) Sink
   Code Ref: ___________________

8. A backflow preventer is required on which of the following?

   a) A laundry tub
   b) An outside hose bibb
   c) A hot-water tank
   d) A water closet

   Code Ref: ________________

9. In supporting a fixture, it is necessary to

   a) Reinforce the wall if the fixture is supported by something other than a pipe
   b) Use only major pipes to support fixtures
   c) Support fixtures independently of pipes
   d) Support fixtures by both pipes and attachment to a wall

   Code Ref: ________________

10. It is at the final inspection that the smoke test may be used. In doing this test you must make sure that:

   a) All traps are not filled
   b) The test is continued for 10 minutes
   c) All openings are blocked
   d) A pressure equivalent to a 50 mm water column is maintained

   Code Ref: ________________

END OF MODULE 11

APPENDICES

ANSWER GUIDE

PLUMBING - HOUSE - 2007

MODULE 1

PRE-COURSE TEST

1.	c)	Building Code Act 1.-(1)
2.	d)	Course material
3.	b)	Div. A, 1.4.1.2.
4.	a)	Building Code Act Section 16
5.	b)	7.2.3.1.(1) & (3)
6.	b)	7.6.3.4.(1)
7.	c)	7.2.7.8.(1)
8.	b)	7.3.4.4.(2)
9.	b)	7.5.6.2.(1)
10.	c)	7.4.9.2.(1)
11.	d)	7.2.5.8.(2)
12.	d)	7.5.1.1.(4)
13.	c)	7.5.6.5.(6)
14.	d)	Course material
15.	a)	7.4.7.1.(7)
16.	b)	See "Numbering System" in Preface to the OBC
17.	c)	BCA 14.-(1)
18.	a)	Tables 7.4.9.3. and 7.6.3.1.
19.	c)	Section 7.2.
20.	c)	7.5.7.2.(1)
21.	b)	BCA 1.-(1) and 8.-(1)
22.	d)	7.4.6.3.(2)&(8
23.	b)	7.7.3.1.(1)
24.	c)	Course Material
25.	a)	BCA Section 37

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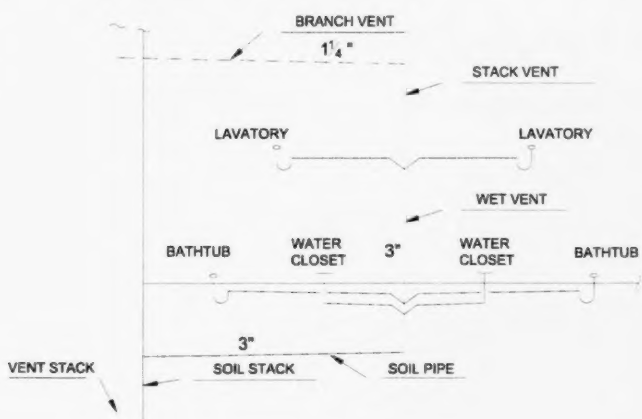

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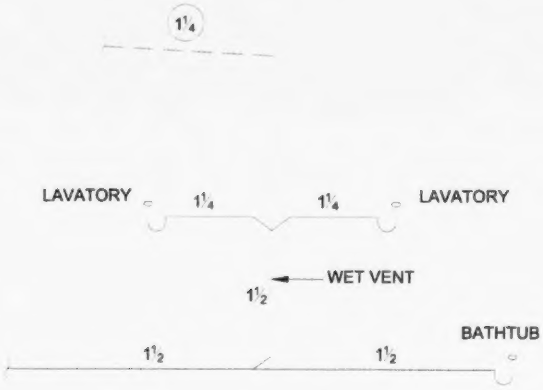


$1\frac{1}{4}$
LAVATORY
$1\frac{1}{4}$
$1\frac{1}{4}$
LAVATORY
WET VENT
$1\frac{1}{2}$
BATHTUB
$1\frac{1}{2}$
$1\frac{1}{2}$

MODULE 2

Exercise 2-1
Answers from Division A of the OBC.

Exercise 2-2

- Inspecting plumbing
- Advising people on the Building Code requirements
- Enforcing regulations and by-laws
- Writing orders
- Provide documentation, notes
- Court Proceedings
- Plan Examination

Exercise 2-3
Class discussion.

Exercise 2-4
Class experiences.

Exercise 2-5: The Ontario Building Code Act

1. Inspector appointment	Section 3(2), 3(3) or 6.1.(4)
2. Enforcement	Section 3 and 6.1
3. Certificate	Section 3(8)
4. By-Laws & regulations	Section 7
5. Issue of permit	Section 8(2)
6. Conditional permit	Section 8(3)
7. Revocation of permit	Section 8(10)
8. Inspection	Section 12(1)
9. Order not to cover	Section 13
10. Inspection of unsafe building	Section 15
11. Entry to dwellings	Section 16
12. Powers of inspector	Section 18
13. Warrant for entry and search	Section 21
14. Disputes	Section 24
15. Equivalents	Section 9
16. Offences	Section 36
17. This Act & municipal by-laws	Section 35

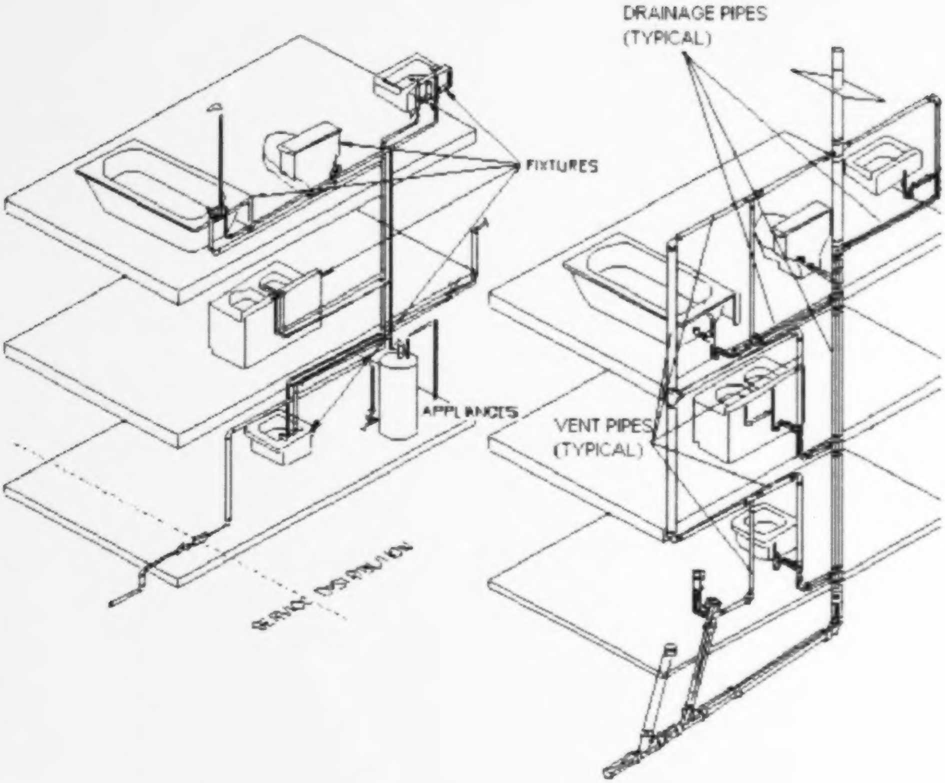
Module 2 QUIZ

1. d) Div A, 1.4.1.2.

2. c) Definitions
3. b) Building Code Act Section 14.-(1)
4. a) Division C Subsection 1.3.5.
5. b) BCA 7.(2)
6. a) 7.6.2.1.(2)
7. b) 7.6.2.4.(5)
8. d) All of the above
9. a)
10. c) Div A, 1.4.1.2.

MODULE 3

Exercise 3-1



Exercise 3-2
Class experiences.

Exercise 3-3
Possible Answers: Leaking supply, blockage, water supply shut off, faulty building control valve, broken main

Exercise 3-4
Class discussion.

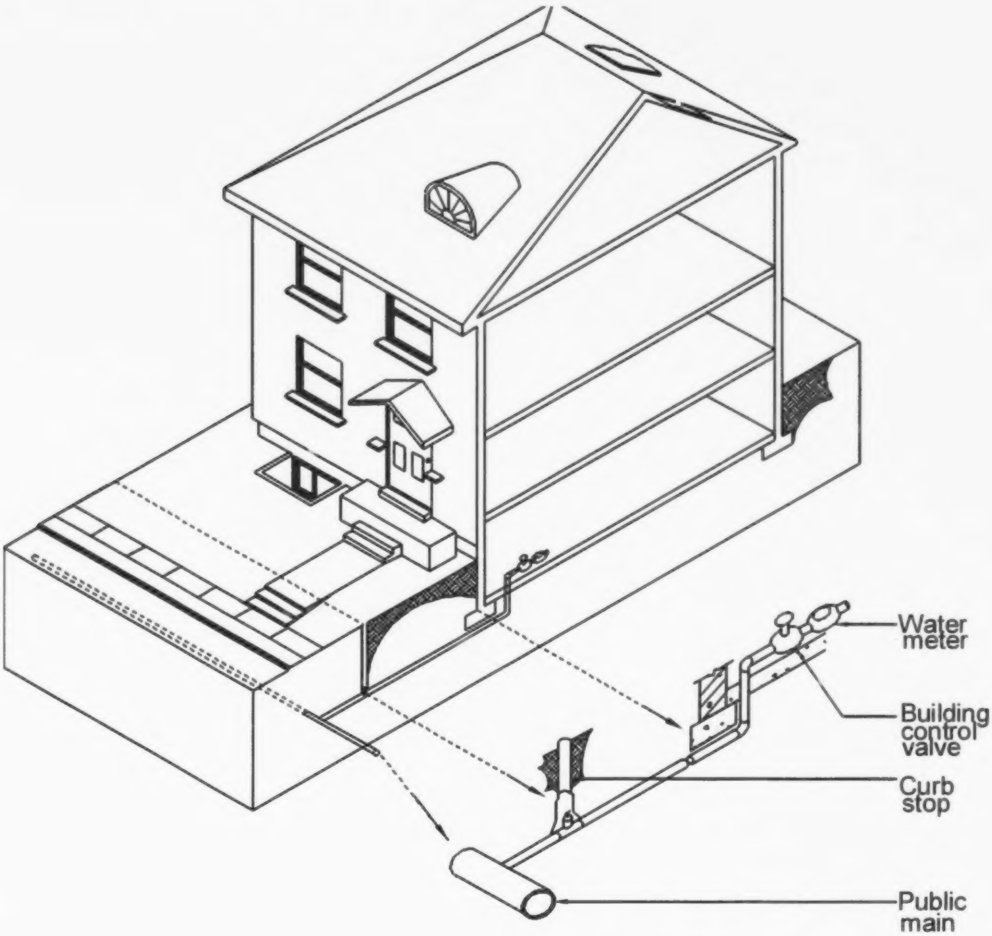
Exercise 3-5
Class experiences.

Module 3 QUIZ

1. d) 7.6.1.3. & Div A 1.4.1.2.
2. a)
3. b)
4. c)
5. b) Div A 1.4.1.2

MODULE 4

Exercise 4-1



Exercise 4-2

Answers in Division A of the OBC.

Exercise 4-3

Possible discussion points:

- some municipalities do not permit service and sanitary piping in the same trench
- some permit storm and sanitary piping together, but require service piping to be separate
- some permit service and sanitary piping together if it meets the OBC

Exercise 4-4

Acceptable and Unacceptable Piping Materials for Water Service Piping
(Section 7.2.)

Materials	Acceptable (yes/no)	Standard	Code Reference
Polyethylene	No – only for water service pipe	-	7.2.5.5.(5).
PEX	Yes	CSA B137.5	7.2.5.7.(1)
PVC	Yes	CSA B137.2 or CSA B137.3	7.2.5.8.(1)
PE /AL/PE	Yes	CSA B137.9	7.2.5.13.(1)
Cast-iron soil pipe	No	-	7.2.6.1.(2)
Galvanized steel	Yes – only in industrial occupancy	ASTM A53/A53M	7.2.6.7.(3).
Copper— K soft	Yes	ASTM B88	7.2.7.4.(1)(a) Table 7.2.7.4..
Copper— L soft	Yes	ASTM B88	7.2.7.4.(1)(a) Table 7.2.7.4.
Lead	No	-	7.2.7.8.
Materials previously used for a purpose other than distribution of potable water	No	-	7.2.1.2.(2).

Exercise 4-5

Water service pipes larger than ¾ inch might be serving a large house with many bathrooms. Article 7.6.3.4. requires that a water-service pipe be sized for peak demand flow. This minimum requirement is sufficient for single dwelling units in general.

Exercise 4-6

- building control valves are required so that water can be shut off to service or modify a supply system
- the extension of the plastic pipe is required so the pipe material can be identified in planning for repairs or new connections
- extension of plastic pipe also provides a practical length for making connections with interior piping and installation of the check valve(if required)

Exercise 4-7

Class experiences.

Exercise 4-8

Pros: Cost effective, ease of installation, safety, saves installation time
Cons: potential damage, potential cross contamination.

Exercise 4-9

Subsection 7.3.5. in your own words.

Exercise 4-10

Water or Air test.

Exercise 4-11

Possible answers: leaking connections, noncompliant connections, noncompliant materials used

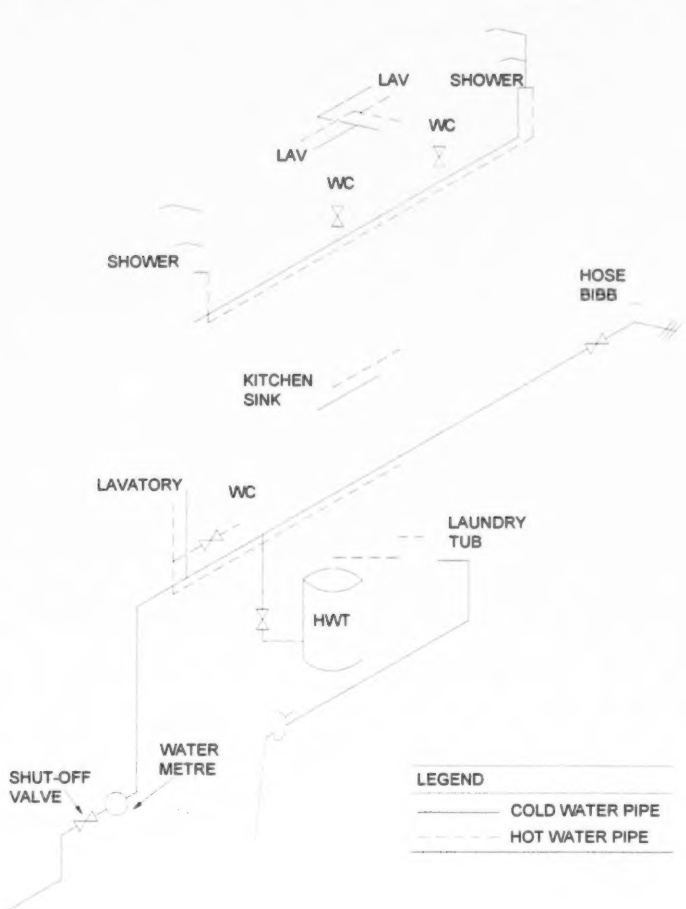
Exercise 4-12

Class discussion.

Module 4 Quiz

1. c) 7.3.5.7.(2)
2. c) 7.2.5.8.(1). and Table 7.2.11.2.
3. c) 7.6.3.4.(1)
4. d) OBC
5. b) Water purveyor
6. a) 7.3.7.2.(1)
7. c) Table 7.2.11.2.
8. a) Course material
9. b) Course material
10. a) 7.6.1.3., Div A 1.4.1.2.

MODULE 5



Exercise 5-1

Definitions from Division A of the OBC.

Exercise 5-2: A Case of Out-of-Site

Possible Answers:

- Inspector should comply with Div. C 1.3.5.3.(1) which requires inspection within 2 days . If not:
- He could inspect 2nd and 3rd floor and record any findings before a final decision is made
- How familiar is he with the contractor's work? If familiar may be confident in installation.

- He could request a air or water test.

Exercise 5-3: Nonmetallic Pipe Materials

Acceptable and Unacceptable Piping Materials for Water Distribution
(Subsection 7.2.5.)

Materials	Cold	Hot	Code Reference
Polyethylene (PE)	Y	N	7.2.5.5.(1)
Chlorinated Poly Vinyl Chloride (CPVC)	Y	Y	7.2.5.9.(1)
Cross-linked polyethylene (PEX)	Y	Y	7.2.5.7.(1)
Polypropylene (PP-R)	Y	Y	7.2.5.15.
Acrylonitrile-Butadiene-Styrene (ABS)	N	N	7.2.5.15.
Polybutylene	N	N	No longer permitted in 7.2.5.

Exercise 5-4

1. ¾ in.—Sentence 7.6.3.1.(4)
2. Min. 3/8 in. Table 7.6.3.1 also enough capacity 7.6.3.1.(5)
3. Max 750 mm, min. ¼ inch inside diameter. Sentence 7.6.3.1.(2)
4. ½ in.—Sentence 7.6.3.1.(1) & Table 7.6.3.1.
5. ½ in. — Sentence 7.6.3.1.(1) & Table 7.6.3.1

Exercise 5-5

1. To permit repairs or seasonal drainage
2. Can put in a drain valve from areas with insufficient slope.

Exercise 5-6

1. To avoid contamination. Markings on the pipes can be recognized by any interested parties.
2. To avoid contamination of the potable-water supply through backflow or cross-connection.

Exercise 5-7: Backflow and Backflow Preventers

1. a) It is a device used to prevent the reverse flow of water from back-siphonage.

   b) Article 7.6.2.10 (1)(2)&(3) require its critical level be less than 25 mm above the flood-level rim of a fixture or tank.

2. For minimum distributing pipe of 1/2" (Table 7.6.3.1.), the air gap must be at least twice the diameter of the distributing pipe (Article 7.6.2.9.): 1/2" × 2 = 1" minimum air gap.

3. No; only hose bibbs outside the building, inside a garage, or where there is an identifiable risk of contamination must have a backflow preventer—Sentence 7.6.2.2.(3).

4. Every fixture not subject to pressures above atmospheric must be protected with a backflow preventer—Sentence 7.6.2.1.(1).

Exercise 5-8

Sentence 7.3.4.1.(1)—pipes must be kept aligned.

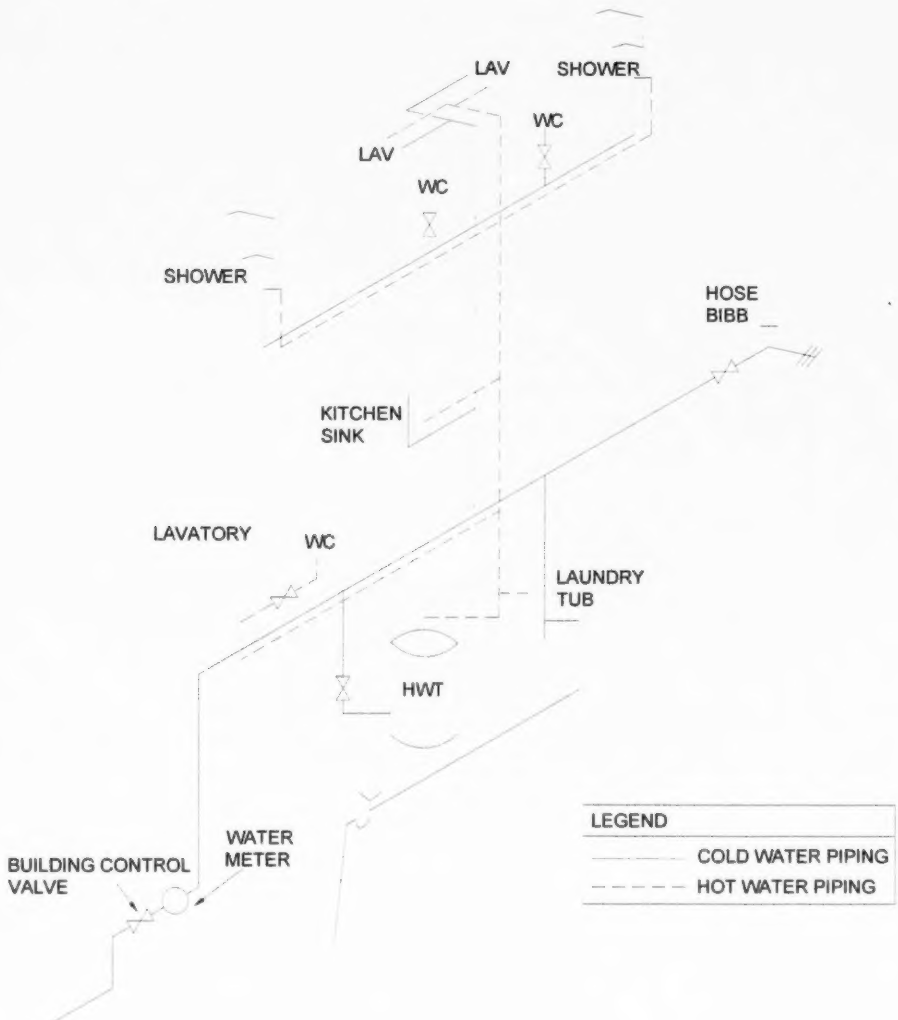
Sentence 7.3.4.1.(3), Article 7.3.4.2.—pipes must be supported independently of fixtures.

Sentence 7.3.4.3.(1)—copper/brass piping supported by another metal must be electrically insulated.

Article 7.3.4.4.—maximum support of 7.5 metres or every alternate storey on vertical piping.

Articles 7.3.4.5. and 7.3.4.6. - horizontal pipe shall be supported.

Exercise 5-9



Exercise 5-10

1. This is because many plastic pipes could be damaged at water temperatures higher than 93°C. Where this is the case, plastic water-service pipes that are connected to a hot-water heater should be protected with a check valve—Article 7.6.1.10.

2. Equal to the size of the outlet of the valve—Clause 7.6.1.12.(5)(a).

3. Between a hot-water tank and a relief valve or the discharge line of the relief valve—Sentence 7.6.1.12.(7).

4. Where the building control valve is 1" or smaller—Sentence 7.6.1.3.(3). May require on hose bibbs—Sentence 7.6.1.9.(1).
5. 1100 KPa or 1½ the maximum test pressure sustained by the tank, whichever is the lesser—Sentence 7.6.1.12.(1).
6. Terminate at indirect connection to floor drain or sump with an air break of min. 300 mm, or terminate 150 – 300 mm from floor and discharges down 7.6.1.12.(5)(b)

Exercise 5-11

Possible answers:

- Water Hammer
- Insufficient water pressure due to incorrect sizing
- Unable to drain the system
- Water piping in exterior walls
- Copper piping touching steel studs
- Prohibited pipe materials

Exercise 5-12

	Water Test	Air Test
Climatic condition	Above freezing temperature	Anytime
Pressure	1000 kPa (145 PSI)	700 kPa (102 PSI)
Duration	One hour	Two hours
Test medium	Potable water	Air

Exercise 5-13

Answers from class.

Exercise 5-14

Possible Checklist:
Freezing protection
Pressure test
Materials
Size & length of piping
Slope of piping
Connections
Cross-connections
Support of piping
Shut-off valves
Backflow preventers
Dissimilar materials

Penetrations of structural members

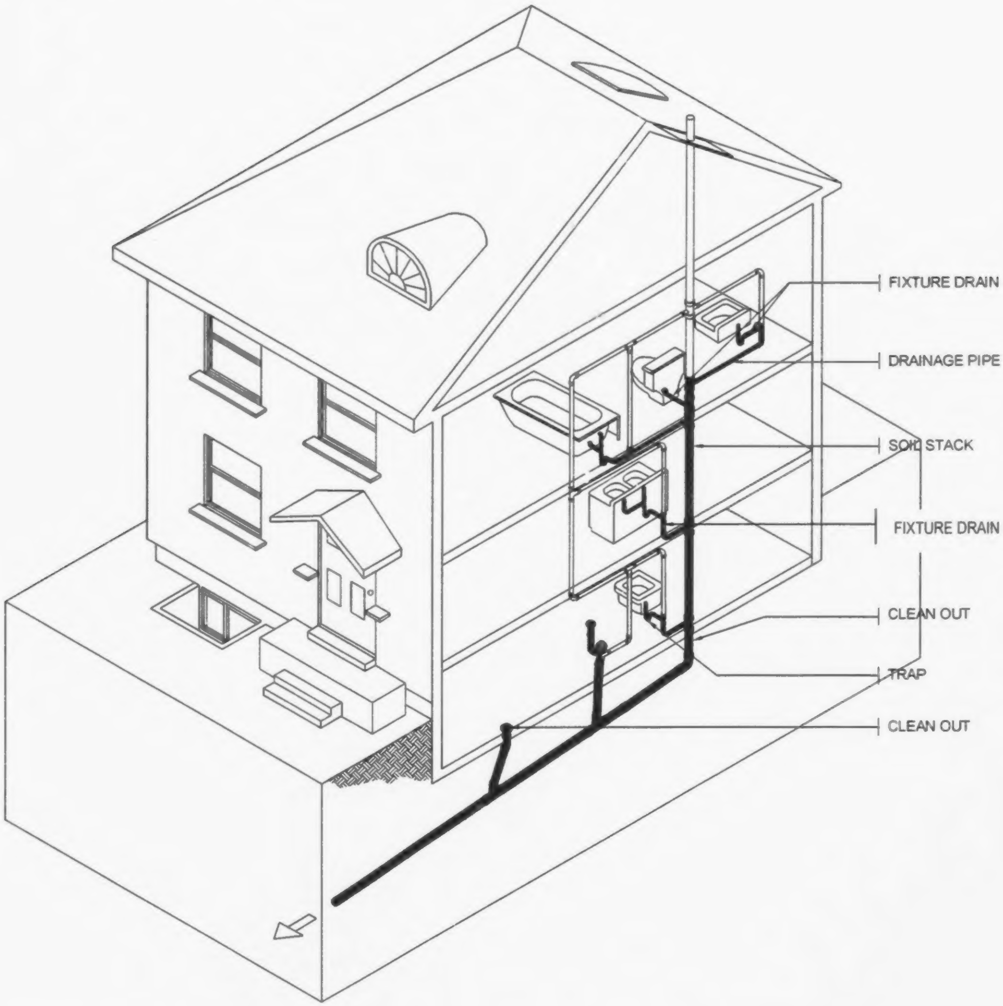
MODULE 5 Quiz

1. c) Div A, 1.4.1.2.
2. d) Div A, 1.4.1.2.
3. a) 7.6.2.9.
4. c) 7.2.7.4.(2), Table 7.2.7.4.
5. a) 7.6.1.4.
6. c) 7.6.3.1.(4)
7. b) 7.6.1.2.(1)
8. d) 7.7.3.1.(1), 7.7.3.2.
9. b) Div A, 1.4.1.2.
10. a) 7.6.1.1.(2)

MODULE 6

Exercise 6-1
Answers in Division A.

Exercise 6-2



Exercise 6-3

Possible answers:

- Back pressure
- Evaporation
- Direct siphonage—rapid flow of water through trap
- Indirect siphonage—suction

Exercise 6-4

Possible answers:
- Could be accumulated soap and hair
- Stagnant water
- No water in trap

Exercise 6-5

1 - 1½"
2 - 3"
3 - 1½"
4 - 2"
5 - 1½"
6 - 1½"
7 - 1½"
8 - 1¼"

Exercise 6-6

1 - 1 ½
2 - 4
3 - 1 ½
4 - 3
5 - 6
6 - 7 ½
7 - 12
8 - 6 - Table 7.4.10.2.

Exercise 6-7

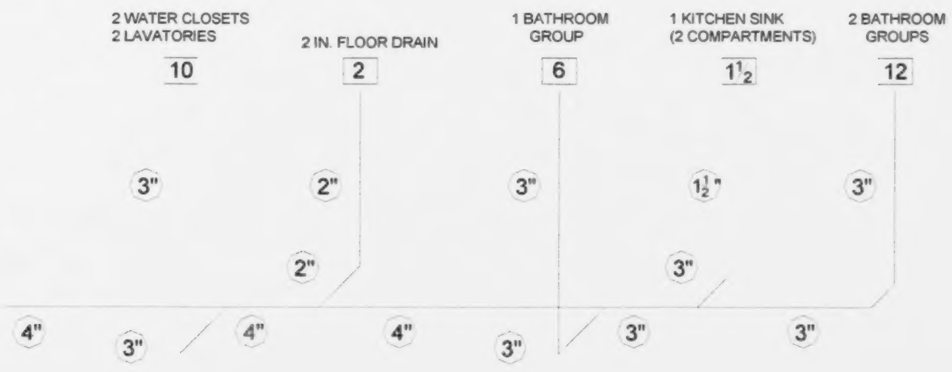
	Fixtures Served by the Vertical Drainage Pipe	Hydraulic Load (Fixture units)	Minimum Size of Vertical Pipe (in)	Code Reference
1	2 lavatories (1¼ in. traps) in a 2 storey house	2	1¼	Table 7.4.10.6.B
2	2 lavatories (1¼ in. traps) and 2 bathtubs in a 2 storey house	5	1½	Table 7.4.10.6.B
3	Flush tank WC	4	3	7.4.9.2.(1)
4	3 bathroom groups total, one per storey (flush tank WCs)	18	3	7.4.9.2.(1)
5	7 water closets (flush tank)		4	7.4.9.2.(3)

		42		
6	12 fixture units from each storey in a 3 storey building	36	3	Table 7.4.10.6.A

Exercise 6-8

	Fixtures Served by the Horizontal Drainage Pipe	Hydraulic Load (Fixture units)	Minimum Size of Horizontal Pipe (in)	Code Reference
1	2 lavatories (1¼ in. traps)	2	1¼	Table 7.4.10.7.
2	One water closet (flush tank)	4	3	7.4.9.2.(1)
3	4 water closets (flush tank)	24	4	7.4.9.2.(2)
4	Two bathroom groups (flush tank)	12	3	7.4.9.2.(1) and Table 7.4.10.8.
5	Building drain with 30 fixture units	30	4	7.4.9.4.(1)

Exercise 6-9



Steps 1 and 2: Determine the fixture units and cumulative fixture units. Table 7.4.9.3.
Step 3: Size vertical pipes. Table 7.4.10.6.A.
Step 4: Size horizontal pipes. Table 7.4.10.8.
Remember to check minimum sizes, Subsection 7.4.9.

Exercise 6-10
Class discussion.

Exercise 6-11
Class experiences.

MODULE 6 QUIZ

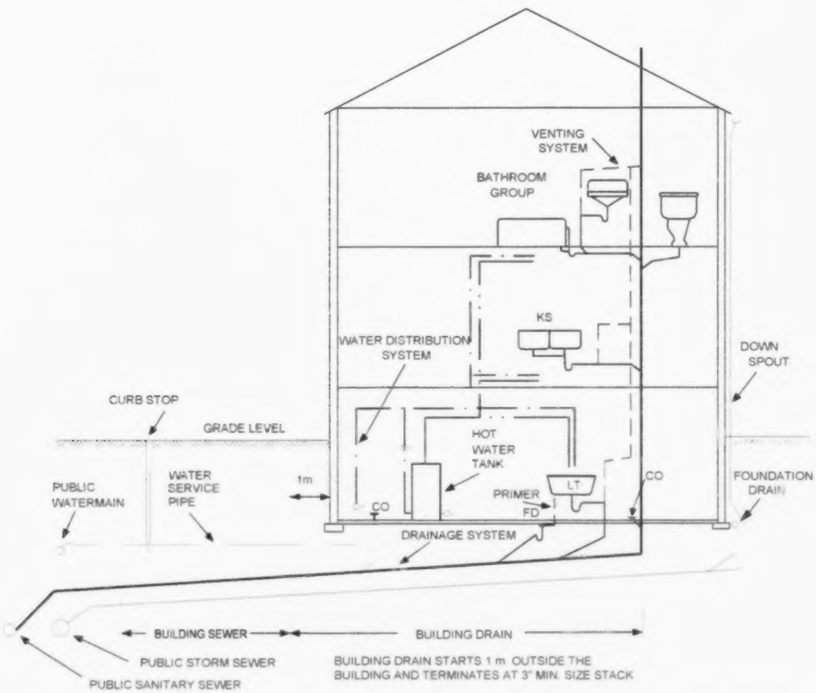
1. b) Div A, 1.4.1.2.
2. d) Div A, 1.4.1.2.
3. b) Course material
4. d) 7.4.6.3.(2)
5 a) Course material
6 c) 7.4.9.1.(1)
7. d) 7.4.10.2.(2)
8. c) 7.5.6.3.(1)
9. a) 7.2.3.1.(1)

MODULE 7

Exercise 7-1

	Fixture Units	Pipe Size (in.)	Code Reference
Soil Stack 1	6+6+1.5 = 13.5	-	Table 7.4.9.3.
Soil Stack 2	4+1 = 5	-	Table 7.4.9.3.
Laundry Tub	1.5	-	Table 7.4.9.3.
Floor Drain	5	-	Table 7.4.10.2.
Point A	13.5	3	Table 7.4.10.8.
Point B	5	3	Table 7.4.10.8.
Point C	13.5+5 = 18.5	4	7.4.9.4.(1)
Point D	18.5+1.5+5 = 25	4	7.4.9.4.(1)

Exercise 7-2



Exercise 7-3

What to think about	What to take along
The type of building	Checklist
What you are going to inspect	Hard hats and boots
Size of pipes and materials that comply with the Code	Extra ball for test
What the site will look like	Flashlight
Materials	Orders
Grade	Tape measure

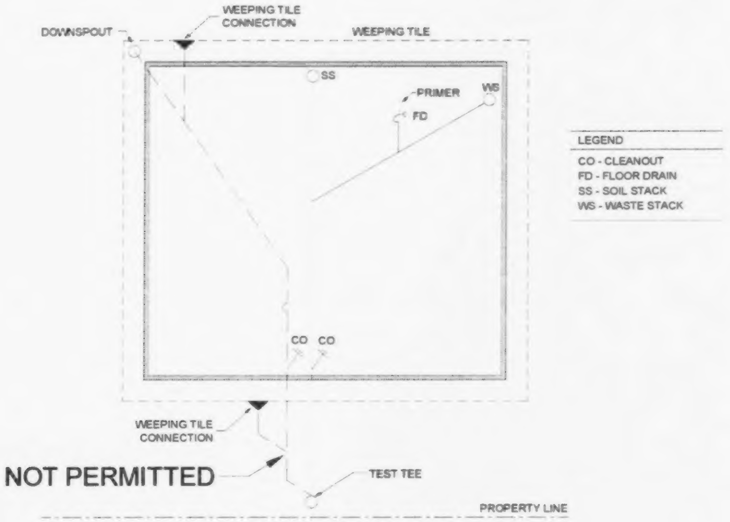
Exercise 7-4

Answers from class.

Exercise 7-5

1. One is two individual sanitary and storm sewers, other one is a combined sewer.
2. The weeping tile is connected to the combined sewer.
3. Most likely not.

Note: Downspout connection to storm drain only if permitted by municipality.
Combined sewers only if permitted by municipality.



<u>Exercise 7-6</u>
Possible answers: Plan can be used by homeowners who want to renovate, plan can be used by municipality for reference for future works or for permit reviews

<u>Exercise 7-7</u>

1. The drain extends from under the house to 1 m outside the house.

2. The drain extends from under the house to 1 m outside the house.

3. The leader is inside the house; the downspout is outside the house.

4. A fixture unit is the measure assigned for calculating hydraulic load. The sanitary unit is the fixture containing sanitary sewage.

5. A floor drain receives water from the floor of a building. A foundation drain collects water from the foundation of a building.

<u>Exercise 7-8</u>
Definitions from Division A.

<u>Exercise 7-9</u>

1. The pipes in the trench, the connection to the municipal sewer
2. Use a ladder to get into the trench, follow safe procedure.

<u>Exercise 7-10</u>

- Try to get contractor to uncover the pipes, if an order not to cover is in place.
- Check Clauses 13(6)(a) to (d) from the Act, to see if any of them can be of use.
- Prohibit the use of such piping under Section 11 of the Act.

Exercise 7-11
Underground Drain and Sewer Pipe Materials
Reference Subsections 7.2.5., 7.2.6., and 7.2.7.

Materials	Building Drain	Building Sewer	Cond-itions	Code Reference	Standard
Asbestos-Cement	Yes	Yes	-	7.2.5.1.(2)	CSA/CGSB-34.9 CSA/CGSB-34.23
Concrete	Yes	Yes	-	7.2.5.3.	CSA A257
Vitrified Clay	Yes	Yes	-	7.2.5.4.(3)	CSA A60.1-M
Polyethylene	Yes	Yes	Note 1	7.2.5.6.(1)	ASTM F714
ABS	Yes	Yes	-	7.2.5.10.(1)	ASTM F628 and CSA B181.1
PVC	Yes	Yes	-	7.2.5.10.(1)	CSA-B181.2
Cast Iron	Yes	Yes	-	7.2.6.1.	CSA-B70
Galvanized Steel	No	No	Note 2	7.2.6.7.(2)	ASTM A53/A53M
Corrugated Steel	No	Yes	Note 3	7.2.6.8.(2)	CSA G401
Copper	Yes	Yes	-	7.2.7.1.	ASTM B42
Brass	Yes	Yes	-	7.2.7.1.	ASTM B43
Copper Tube – Type K & L hard	Yes	Yes	-	Table 7.2.7.4.	ASTM B306
Lead	Yes	No	-	7.2.7.8.(1)	-

Note 1 – Underground Rehab only
Note 2 – Above Ground use only
Note 3 – Storm Drainage only

Exercise 7-12

1. a) 4 inches (7.4.9.4.(1))
   b) 4 inches (7.4.9.4.(2))

2. a) 3 inches (7.4.9.2.(1))
   b) 4 inches (7.4.9.2.(2))

Exercise 7-13

Hydraulic Load for Typical Fixtures in a House
(Reference Table 7.4.9.3.)

Fixtures		Fixture Units
1.	WC (flush tank)	4
2.	Lavatory	1
3.	Kitchen sink	1.5
4.	Laundry tub	1.5
5.	Two bathroom groups	$6 \times 2 = 12$
6.	Floor drain	2
7.	Total	22

Exercise 7-14

1. 3 inch
2. Minimum stated in Code is 4" per 7.4.9.4.(1)
3. Approximately 28 gpm based on interpolation of Table 7.4.10.5.
   Or, consult Table 7.4.10.5. in Appendix (Volume 2), 29 gpm

Exercise 7-15

1. 1:100 (1%)
2. Use the ball test, "Eyeball" it, use a level, use a transit

Module 7 Quiz

1 c) 7.2.5.3.
2 c) 7.4.9.4.(1)
3 c) Table 7.4.10.8
4 d) 7.3.4.6.
5.

Stack No.	Fixtures	F.U.s	Total F.U.s
Soil Stack 1	6 - bathroom groups	6x6=36	
	6 - kitchen sinks	6x1.5=9	45
Waste Stack 1	6 – 3 in. floor drains	6x3=18	
	6 – 1 ½ in auto washers	6x1.5=9	21
Soil Stack 2	3 – bathroom groups	3*6=18	
	3 – kitchen sinks	3x1.5=4.5	22.5
Waste Stack 2	3 – 2 in. floor drains	3x2=6	
	3 – 1 ½ in. auto washers	3x1.5=4.5	10.5
Soil Stack 3	2 – bathroom groups	2x6=12	
	2 – kitchen sinks	2x1.5=3	
	2 – 2 in. floor drains	2x2=4	
	2 – 1 ½ auto washers	2x1.5=3	22

Location	Fixture Units/Sizing Considerations	Pipe Size
A	22 fu, 2WCs	3 in.
B	10.5 fu, no WCs, Table 7.4.10.6.B. Col.3	2 in.
C	22.5 fu, 3WCs	3 in.
D	21 fu, no WCs, but 3 in floor drains require 3 in. drain 7.4.9.1.(1)	3 in.
E	45 fu, 6 WCs, 7.4.9.2.(3) not yet applicable, max 2 WC per floor so 3 in. horizontal branches, Table 7.4.10.6.A requires 3 in.	3 in.
1	22 fu, 2 WCs, building drain min 4 in. 7.4.9.4.(1)	4 in.
2	B+C = 33 fu, 3 WCs, downstream of 3rd WC fixture drain, 7.4.9.2.(2)	4 in.
3	A+B+C = 55 fu, 5 WCs, building drain min 4 in. 7.4.9.4.(1), also not lesser than upstream drainage pipes 7.4.9.1.(1)	4 in.
4	D+E = 66 fu, 6WCs, 3 in. pipes upstream, Table 7.4.10.8	4 in.
5	A+B+C+D+E or 3+4 = 111 fu, 11 WCs, building drain min 4 in. 7.4.9.4.(1), 4 in. ok Table 7.4.10.8.	4 in.

MODULE 8

Exercise 8-1

1. See sewer use by-laws
2. By running water in the drainage piping and checking the manholes on the street side, or by using fluorescent dyes

Exercise 8-2

From SA-1, [F81 - OH2.1], [F81-OP5]

Exercise 8-3

1. Granular material with at least 50% passing a 1/4" sieve and 100% passing a 1/2" sieve. See Appendix A for 7.3.4.6.(1)

2. Recommended by the piping manufacturers, or follow CSA B181.11 or CSA B182.11 Standards

3. See Sentence 7.3.4.6.(2) of the Code

4. Look at the bedding,, walk on the pipe to see if it moves

5. The wall cannot bear on the pipe. Article 7.3.5.3.

Exercise 8-4

1. Water, Ball or Air Test
2. The piping installer

Exercise 8-5

- The ball could get stuck
- The contractor may try to cheat by putting one ball in and pulling another ball out of the pipe at the test tee
- Test tees may have been removed, so the ball is lost into the municipal sewer

Exercise 8-6

Answers from class. Water test as per Article 7.3.6.4. Test for 15 minutes. 7.3.6.4.(2)(b)

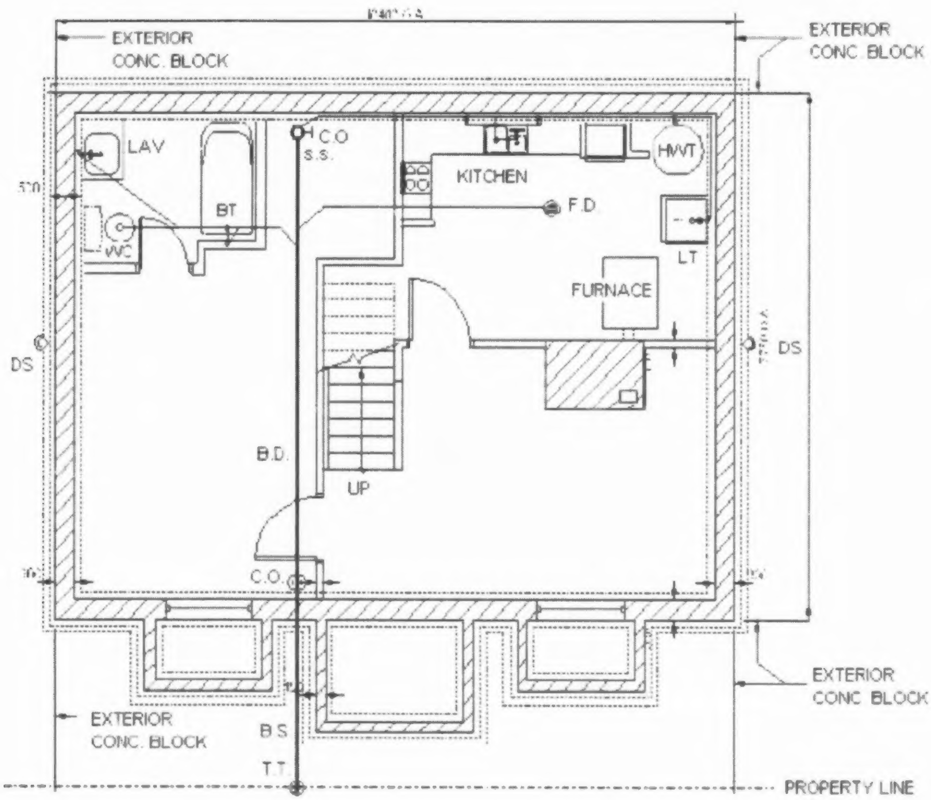
Exercise 8-8

Possible answers: Improper grading—not enough slope to cause the ball to roll through the pipe (How do you retrieve the ball?), Wrong materials used, Leaking joints in pipes, improper bedding, saran wrap for joints

Exercise 8-9
Diagram next page.

Exercise 8-10
Inspection report generated by the class.

Exercise 8-9

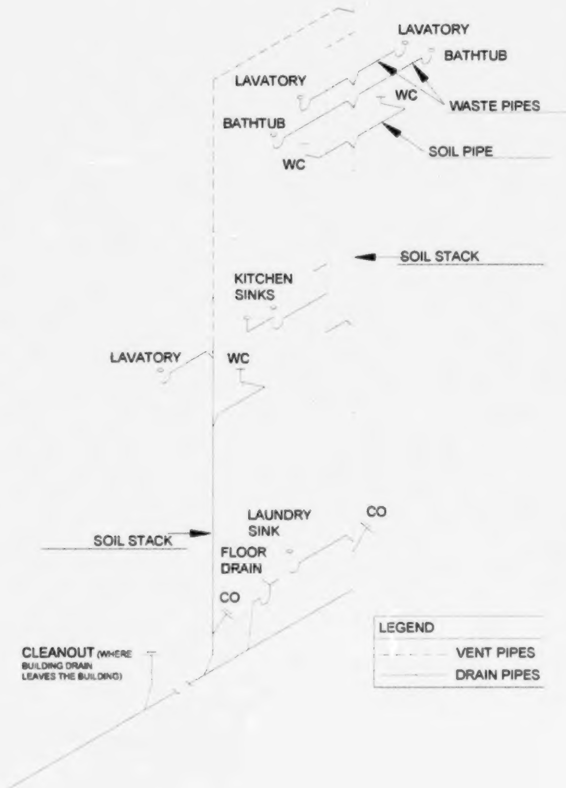


MODULE 8 QUIZ

1 d) 7.3.6.
2 b)
3 d) Div A 1.4.1.2.
4 a) 7.3.6.7.
5 c)
6 d)
7 a) 7.3.4.6.(1)
8 b) 7.3.5.1.(1)
9 c) 7.3.4.6.(2)

MODULE 9

Exercise 9-1



Exercise 9-2

Preparation list for the inspection of stacks and wastes:

- Check time
- Review pertinent documents; for example, permit, plans and field notes
- Determine what test must be done—depends on weather
- Decide what to bring: hard hat, safety shoes, Code and OBCA, tape measure, flashlight, paper (notebook)
- Ask contractor what testing equipment will be there
- Materials may be different

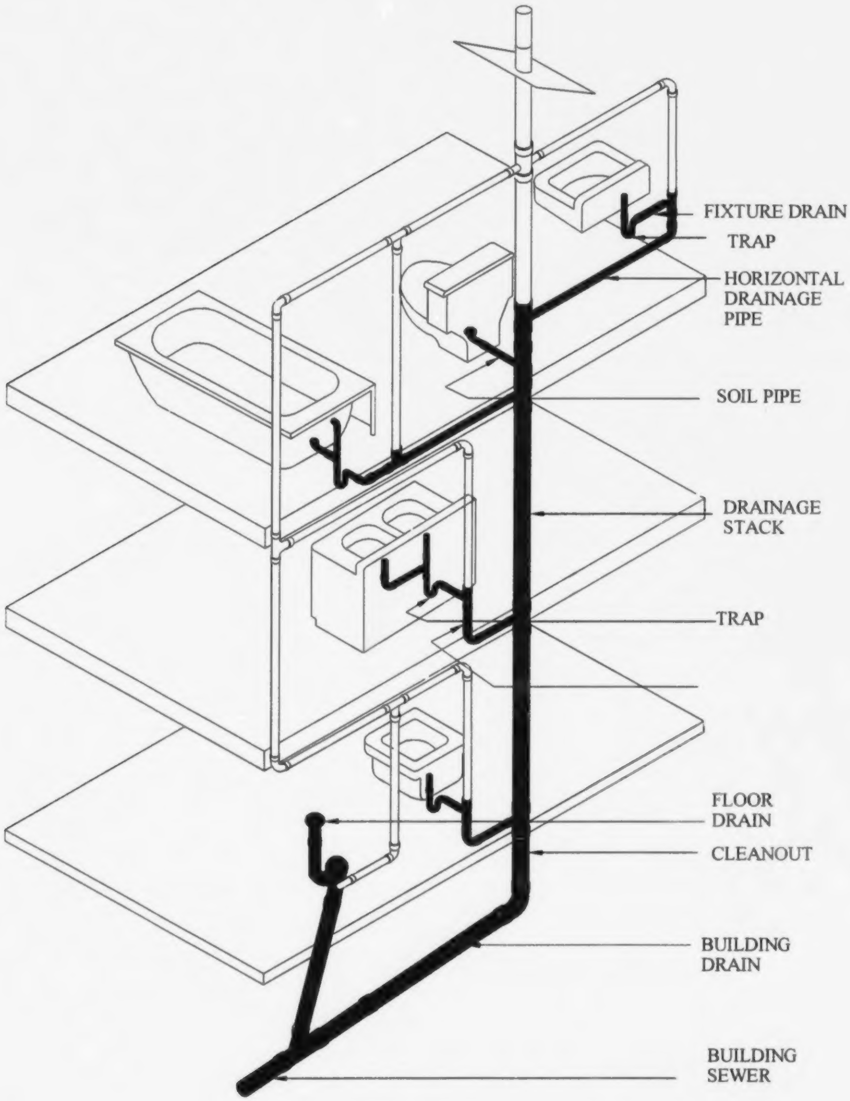
Exercise 9-3

1. 8 waste pipes
2. Soil stacks

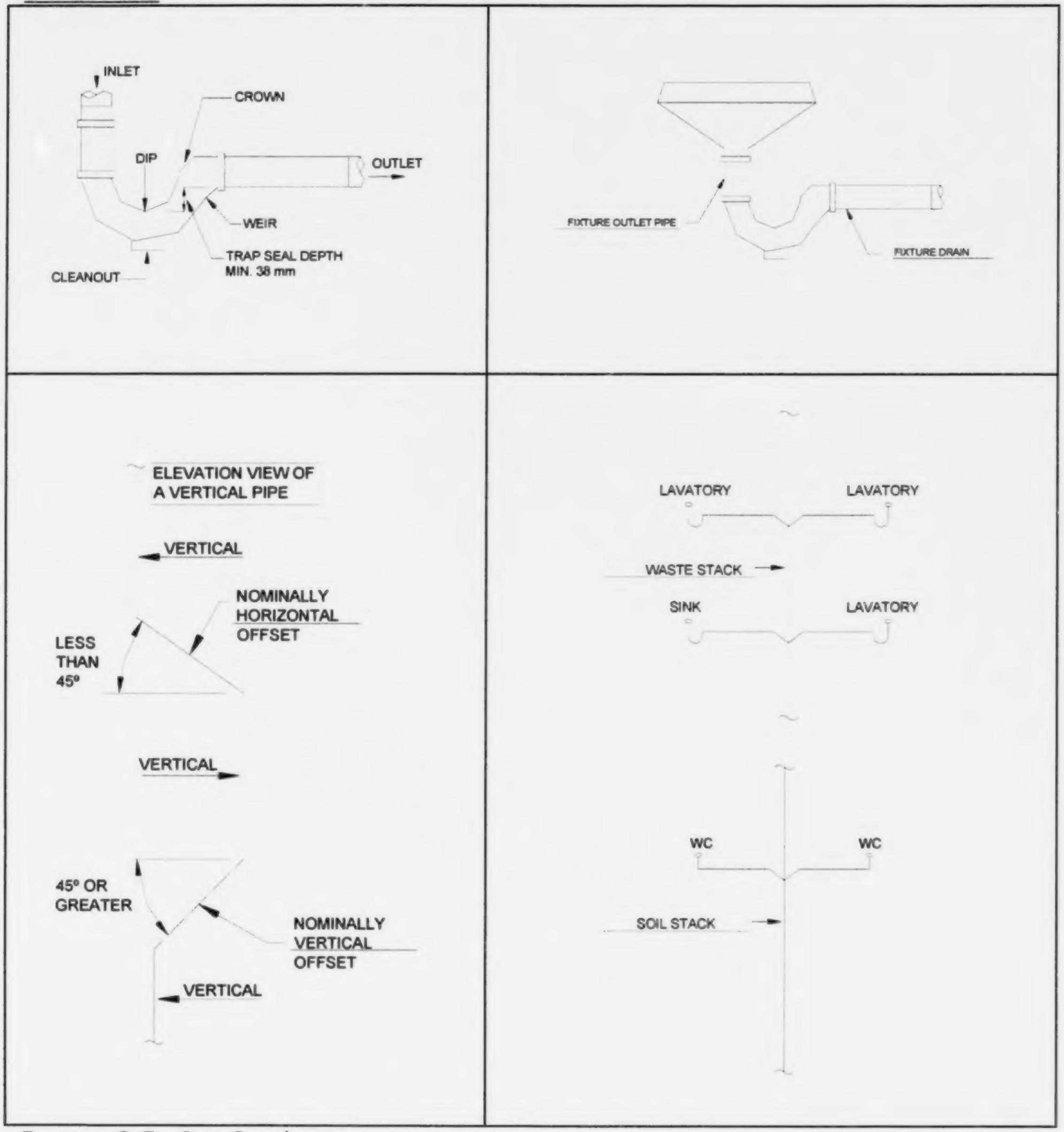
Exercise 9-4

Definitions from Division A of the OBC.

Exercise 9-5



Exercise 9-6



Exercise 9-7: Site Conditions

- Advise contractor not to do this again, as he will be charged in future.
- Inspect what he has done (if possible), and inspect the rest when you come to look at the venting system.

Exercise 9-8

1. underground, 7.2.5.10, inside or under a building in a sanitary drainage or venting system 7.2.5.12(1)., inside in a storm drainage system 7.2.5.12.(2)
2. CAN/CGSB-34-22, CAN/CGSB-34.9 for piping, 7.2.5.1.(1) and (2)
3. yes, only in underground drainage systems, Article 7.2.5.4.

Exercise 9-9

1. ASTM B43— Sentence 7.2.7.1.(2), ANSI B16.24— Sentence 7.2.7.2.(1)

2. Soft types M, K and L—Table 7.2.7.4.

3. a change in size of a lead closet bend shall be in the vertical section of the bend or made so that no retention of liquid in the bend —Article 7.2.7.8.

Exercise 9-10

1.Bathtub – 11/2 FU Lavatory – 11/2
FU Total – 3 FU Branch size = 11/2
Tables 7.4.9.3. and 7.4.10.7.

2. 3"—Sentence 7.4.9.2.(1) or Table 7.4.9.3.

3. Three fixture units Table 7.4.10.2

4. Pipe smaller than 3" cannot serve water closets —Sentence 7.4.9.2.(1)

5. 65% —Sentence 7.4.10.8.(2), 29% —Sentence 7.4.10.6.(3)
To ensure optimum flow and function and reduce chance of blockages or siphonage, to promote a self-cleaning flow.

6. water closets require minimum 3 in stack, 7.4.9.2.(1), Table 7.4.10.6.A shows 3 in soil stack serves up to 102 fixture units

7.50 fixture units, Table 7.4.10.5.

8. 4 in. size, Table 7.4.10.8.

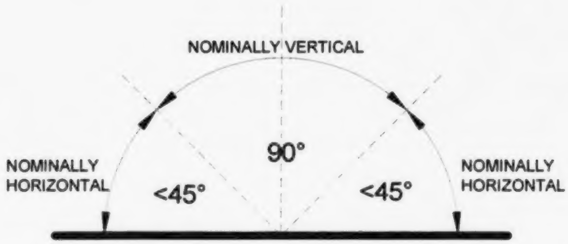
9. 22 or 23 Fus, depending on the trap size

10. 3 in - 7.4.9.2.(1)

11. 180 Fus/ 4 Fu per WC = 45 WCs, Tables 7.4.9.3. and 7.4.10.8.

Exercise 9-11

Definitions from Division A.



Exercise 9-12

Consult OBC Table 7.2.4.5. for answers

Exercise 9-13: Joints and Connections

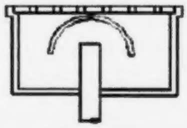
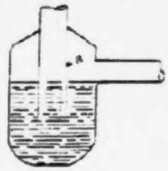
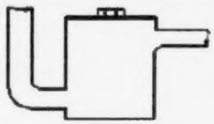
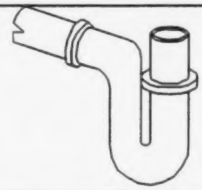
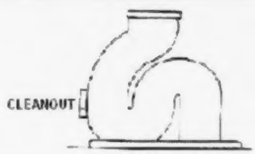
1. by terminating the fixture drain above the flood level rim of a directly connected fixture to form an air break, Sentence 7.3.3.11.(1)
2. 75 mm, Sentence 7.3.3.8.(5)
3. square edge or shoulder is not permitted on the inside of the pipe or fitting, Sentence 7.3.3.1.(5)
4. in a venting system or in a drainage system, except to connect a fixture trap to a fixture drain in an accessible location, Sentence 7.3.3.4.(2)

Exercise 9-14: Support

Read Article 7.3.4.5. and then write out the support requirements for each type of material.

ABS or PVC pipe—Clause 7.3.4.5.(2)(e)
Asbestos-cement pipe—Clause 7.3.4.5.(2)(d)
Cast-iron pipe—Clause 7.3.4.5.(2)(c)
CPVC plastic pipe—Clause 7.3.4.5.(2)(f)
Lead pipe—Clause 7.3.4.5.(2)(b)
Copper or brass pipe—Clause 7.3.4.5.(2)(g)
Steel pipe—Clause 7.3.4.5.(2)(a)
Aluminum pipe—Clause 7.3.4.5.(2)(h)

Exercise 9-15

Type of Trap	Sketch	Appropriate Uses
Bell trap	 BELL TRAP	Sentence 7.2.3.1.(4)
Bottle trap		Sentences 7.2.3.1.(6) & (7)
Drum trap	 DRUM TRAP	Sentence 7.2.3.1.(5)
P-trap		Sentence 7.2.3.1.(3)
S-trap	 S-TRAP STANDARD	Sentence 7.2.3.1.(4)

Exercise 9-16: Cleanouts

Exercise 9-17

1. Water Test and Air Test
   Final test (just on final inspection)
   Ball test on building drains and building sewers only
2. Water test or air test
3. If a water test is not possible; e.g., when the temperature is below freezing.
4. On building drains and sewers underground, Sentence 7.3.6.1.(5), Sentence 7.3.6.1.(5)
5. In accordance with Article 7.3.6.6.

Exercise 9-18

Common deficiencies of stacks and waste pipes:

- Insufficient support
- Blockages in connections
- Leaking pipes
- Use of incorrect fittings
- Incorrect connections—wye fittings installed backwards

Exercise 9-19

Inspection reports by class.

Exercise 9-20

Pipe	Drain Pipe / Drain Pipe Serving...	Size (in.)	Reference
A	Lavatory	11/4	Table 7.4.9.3.
B	Bathtub	1 1/2	Table 7.4.9.3.
C	Water closet	3	7.4.9.2.(1)
D	Kitchen sink	1 1/2	Table 7.4.9.3.
E	Laundry sink	1 1/2	Table 7.4.9.3.
F	Floor drain	2	Table 7.4.9.3
G	Soil stack	3	7.4.9.2.(1) and 7.5.7.2.(3)
H	Soil stack	3	7.4.9.2.(1) and 7.5.7.2.(3)
J	Soil stack	3	7.4.9.2.(1)
K	Building drain	4	7.4.9.4.(1)
L	Building Sewer	4	7.4.9.4.(1)

Module 9 Quiz

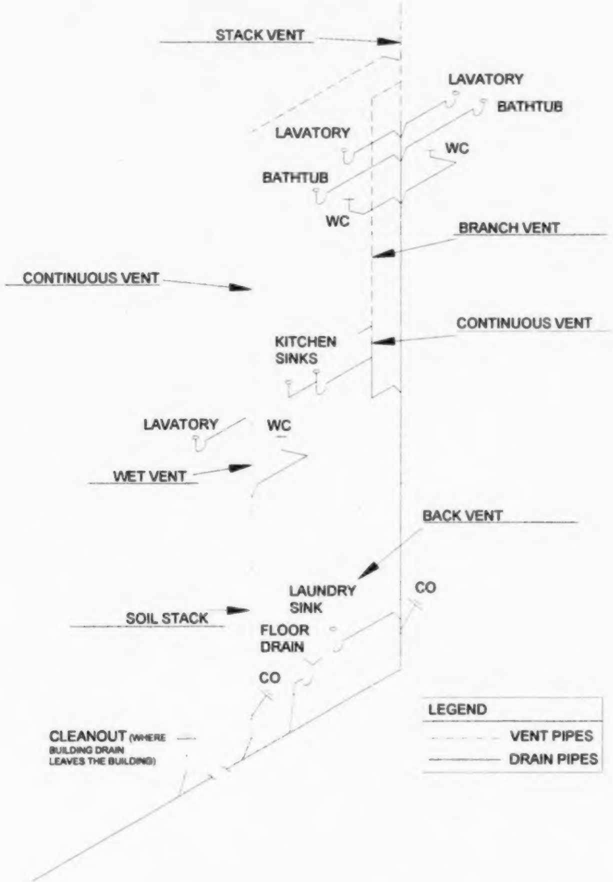
1. b) Div. A, 1.4.1.2.
2. b) 7.2.3.1.(1)&(3)
3. d) Div. A, 1.4.1.2.
4. c)
5. a)7.4.9.1.(1)
6. b) 7.4.8.1.(1)
7. c) 7.2.4.4.(1)
8. d) 7.4.10.1.(1)(a)&(b)
9. a)7.3.4.4.
10. b)
11. b)
12. d)Table 7.2.7.4.

13. c)7.2.3.1.(1)(b)
14. c)7.2.3.1.(3)(a)
15. a)7.3.3.11.(1)

MODULE 0

Exercise 10-1
Make a preliminary inspection or contact the renovator to talk over his plans.

Exercise 10-2
All Definitions can be found in Division A of the OBC



Exercise 10-3: Definitions

1. Acrylonitrile butadiene styrene, **7.2.5.10.(1)(a)**

2. Polyvinyl chloride, **7.2.5.8.(1)**

Exercise 10-4

Materials Permitted in the Venting System
(See Subsections 7.2.5., 7.2.6., 7.2.7.)

Type of Pipe Material	Applicable Standard	OBC Reference	Application in Venting Systems
ABS	ASTM F628 CSA B181.1	7.2.5.12.(1)(a) 7.2.5.12.(1)(b)	Inside or under a building
PVC	CSA B181.2	7.2.5.12.(1)(c)	Inside or under a building
Cast iron	CSA B70	7.2.6.1.(1)	Anywhere
Galvanized steel	ASTM A53	7.2.6.7.(2) & (4)	Above ground
Copper tube	ASTM B306	7.2.7.4. (1)(b)	Only K&L hard permitted under ground, only hard types and DWV permitted above ground, see Table 7.2.7.4.
Brass	ASTM B43	7.2.7.1.(2)	No restrictions

Exercise 10 – 5

1) Not less than twice the size of the fixture drain. If closer, it could promote evaporation of the trap or waste could splash up into the vent eventually causing it to clog. Also prevents siphonage. Clause 7.5.6.3.(1)(a)

2) 1 in 50. Helps to promote self-cleansing. Table 7.5.6.3.

3) Not more than 1.5 metres for 2 in. and smaller traps. Maximum length is up to 5 m for a 6 in. trap. If too long, the total amount of fall could exceed the diameter of the drain pipe causing self-induced siphonage Permitted length increases as trap size increases because the diameter of the pipe allows a greater fall before self-induced siphonage would occur. Table 7.5.6.3.

4) Not greater than its inside diameter. Same principal as above. Clause 7.5.6.3.(1)(b).

5) Not more than 135 degrees cumulative change of direction. This allows for waste to flow with little restriction. Clause 7.5.6.3.(1)(c).

Exercise 10-6

Vent pipe means a pipe that is part of a venting system. Div. A 1.4.1.2.

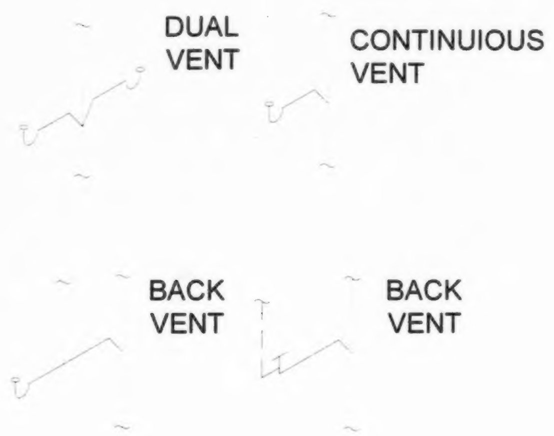
Exercise 10-7

1. Continuous vent means a vent pipe that is an extension of a vertical section of a branch of fixture drain.

2. Back vent means a pipe that is installed to vent a trap off the horizontal section of a fixture drain or the vertical leg of a water closet or other fixture that has an integral siphonic flushing action and "back vented" has a corresponding meaning.

3. A continuous waste vent is an extension of a vertical branch of a fixture drain; a dry vent is not an extension of the fixture drain.

4.



Exercise 10-8

The definition of branch vent can be found in Division A of the OBC.

Exercise 10-9

Advantages: Less piping to be installed, waste water flushes vent to keep it clean

Disadvantages: If wet vent becomes blocked, the vent for the other fixture is also blocked. Also waste accumulation may reduce diameter and effectiveness of the vent.

Exercise 10-10

1. to 4. Definitions in Division A of the OBC.

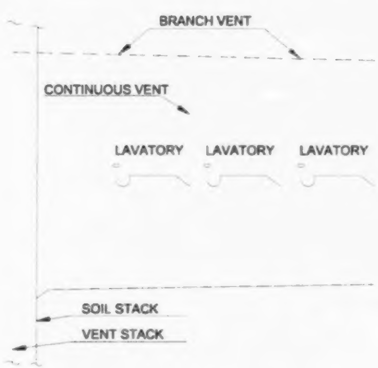
5. Stack venting has fixture wastes connected to it; a stack vent is the continuation of a soil or waste stack.

6. A vent stack is used in conjunction with other stacks; a stack vent is an extension of the soil or waste stacks.

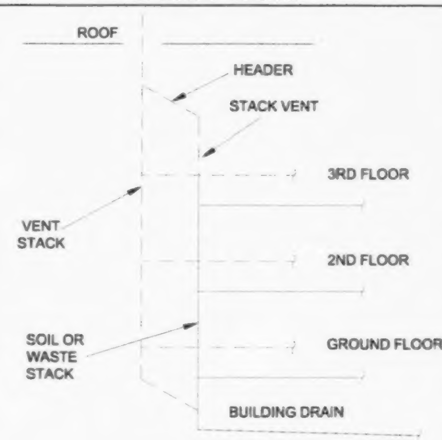
Exercise 10-11

BACK VENT

DUAL VENT

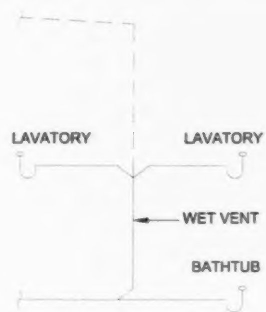


BRANCH VENT



STACK VENT

CONTINUOUS VENT



WET VENT

Exercise 10-12

Use Table 7.5.7.1.and refer to 7.4.9.3. for trap sizes

1. An individual vent serving a domestic clothes washer.
   Assume 1 ½ in trap, 1 ¼ in vent pipe

2. A dual vent serving two water closets.
   Equivalent to 3 in. trap, 1 ½ in. vent pipe

3. A dual vent serving a 2 inl. Trap and a 1 ½ in. trap.
   Based on largest trap served, 1 ½ in. vent pipe.

Exercise 10-13

Step 1. Determine the hydraulic loads of each fixture.

Find these from Table 7.4.9.3.

Lavatory	1 fixture unit
Kitchen Sink	1.5 fixture units
2 head shower	3 fixture units
WC (flush tank)	4 fixture units

Step 2. Determine the hydraulic load carried by the wet vent.

The wet vent does not drain the water closet, so this is not included in the calculation, as per Sentence 7.5.8.1.(2). But the wet vent must consider the hydraulic load of the kitchen sink since as per 7.5.2.1.(f).

Wet vent hydraulic load = lavatory + lavatory + 2-head shower + 2-head shower + kitchen sink = 9 fixture units

Step 3. Size the wet vent.

From Table 7.5.8.1., the wet vent is serving a water closet, so Column 3 is used. Since the hydraulic load is 9 fixture units, the wet vent pipe size is 4 in.

Step 4. Determine the hydraulic load served by the continuous vent.

Use only the hydraulic load that is wet vented as per Clause 7.5.2.1.(1)(g). The kitchen sink is separately vented, and is not included in the calculation.

Continuous vent hydraulic load = lavatory + lavatory + 2-head shower + 2-head shower + flush tank WC = 12 fixture units

Step 5. Size the continuous vent.

From Table 7.5.8.3., a hydraulic load of 12 fixture units and a length of 4 metres will be adequately served by a 1 ¼ in. vent pipe. However, since the wet vent serves a water closet with a 3 in. trap, the continuous vent is required to be 1 ½ in.

Note that the branch drain downstream of the wet vent is sized based on the hydraulic load served, and on the size of the wet vent upstream. Branch hydraulic load = 2 lavatories, 2 2-head showers + kitchen sink + flush tank WC = 13.5 fixture units. The minimum size for this pipe is 3 inches based on Table 7.4.10.8. However 7.4.9.1.(1) prohibits a drainage pipe to drain to one of lesser size, so the branch drain downstream is required to be 4 in.

<u>Exercise 10-14</u>

Same as 10-13, except the kitchen sink is now wet venting the WC, so there are now 2 wet vents.

"Lavatory Wet Vent"

Wet vent hydraulic load = lavatory + lavatory + 2-head shower + 2-head shower = 8 fixture units.

From Table 7.5.8.1., the wet vent is not serving a water closet, so Column 2 is used. Since the hydraulic load is 8 fixture units, the wet vent pipe size is 3 in.

Continuous vent hydraulic load = lavatory + lavatory + 2-head shower + 2-head shower = 8 fixture units. The kitchen sink and water closet are separately vented.

From Table 7.5.8.3., a hydraulic load of 8 fixture units and a length of 4 metres will be adequately served by a 1 ¼ in. vent pipe.

"Kitchen Sink Wet Vent"

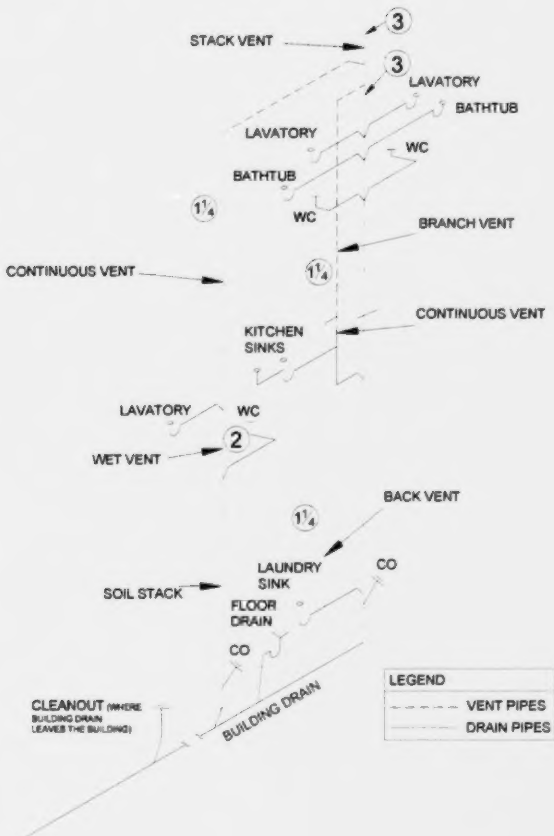
Wet vent hydraulic load = kitchen sink = 1.5 fixture units.

From Table 7.5.8.1., the wet vent is serving a water closet, so Column 3 is used. Since the hydraulic load is 1.5 fixture units, the wet vent pipe size is 2 in.

Continuous vent hydraulic load = kitchen sink + flush tank WC= 5.5 fixture units.

From Table 7.5.8.3., a hydraulic load of 5.5 fixture units and a length of 4 metres will be adequately served by a 1 ¼ in. vent pipe. However, since the wet vent serves a water closet with a 3 in. trap, the continuous vent is required to be 1 ½ in.

Exercise 10-15



Back Vent 7.5.7.1., 7.5.8.2., 7.4.9.3.
Wet Vent 7.5.8.1.
Branch Vent 7.5.8.3.
Stack Vent 7.5.8.4.

Exercise 10-16

If the slip joint leaks in a venting system it may not be noticed. A slip joint in a drainage system may cause water leakage in a concealed location.

Exercise 10-17

1. Must be supported every 7.5 m or 2 storeys—Article 7.3.4.4. Supports must be at its base with metal rests; anchors must allow for thermal expansion and contraction stresses. See Articles 7.3.4.3 & 7.3.3.10.

2. According to Article 7.3.4.5.:
ABS and PVC: maximum interval of 1.2 m, at the ends of branches and if the pipe is a fixture drain that is more than 1 m in length, as close as possible to the trap

3. Must be aligned without added strain on the pipe; the pipe shall not be bent or pulled into position after being welded; and hangers shall not compress, cut or abrade the pipe—Sentence 7.3.4.5.(3).

4. Support vent piping, stable and secure if 2000 mm or more above roof, Article 7.3.4.7. , Sentence 7.5.6.5.(7).

Exercise 10-18

At least 3" (one trade size smaller than the inlet drain) 7.5.7.7., connected to the top of the tank 7.5.5.1.

Exercise 10-19
Answers from the class.

Exercise 10-20: The Air Test

- Seal all openings with test plugs
- Pump the system full of air to at least 5 psi (pounds per square inch)
- Wait for 15 minutes
- Watch the pressure gauge to see if any air escapes

Exercise 10-21
Answers from the class.

Exercise 10-22
Checklist developed by class.

Module 10 QUIZ

1 c) 7.5.1.1.(1)
2 c) Div.A 1.4.1.2.
3 c) Table 7.2.7.4.
4 d) 7.5.8.4.(5)
5 b) 7.5.8.3.
6 c) 7.5.8.3.
7 a) 7.5.5.5.(2)
8 a) 7.5.6.3.(1)

9 a) 7.3.4.5.(2)(e)
10 c) 7.5.6.2.(2)
11 a) 7.3.6.3.(1)
12 d) 7.5.4.2.(1)
13 b) 7.5.6.2.(1)
14 c) 7.2.5.10.(1)
15 d) 7.5.5.4.(1)
16 b) Div. A 1.4.1.2.
17 d) 7.5.2.1.(1)(k)
18 c) 7.5.2.1.(1)(b)
19 b) Table 7.5.8.1.
20 a) 7.5.1.1.(3)

MODULE 1

Exercise 11-1

1.

- Water Closet
- Wash basin or lavatory
- Bath tub
- Sink
- Floor drain (where a basement exist)
- Laundry facility

2.

- Shower stall
- Water softener
- Floor drain
- Dishwasher
- Hot-water tank

Exercise 11-2

- Review plans, inspection field notes
- Think about how the project has been going so far
- Are any problems anticipated? What are they?
- What test must be done this time?
- What things should I check on from prior inspections?

Exercise 11-3
Answers in Division A of the OBC.

Exercise 11-4
Answers from the class.

Exercise 11-5
1. Water cannot leak through the walls or floor—Sentence 7.2.2.3.(1).

2. Not more than six—Sentence 7.2.2.3.(2).

3. A dishwashing sink and a food-preparation sink—Article 7.2.2.4.

4. A trough urinal—Article 7.2.2.7.

Exercise 11-6

1. 8.35 l/min @ 413 kPa 60 psi —Table 7.6.4.1.

2. 13.25 l per flush—Sentence 7.6.4.2.(2)

3. a) CAN/CSA B45.0, General Requirements for Plumbing Fixtures Sentence 7.6.4.2.(1).

   b) No, does not exempt Sentence (1), but in practice would be required to meet 7.2.1.2.(1)

4. Fixtures that are located in a heritage building, care or detention occupancy or passenger station—Sentence 7.6.4.2.(4).

Exercise 11-7

Size of Fixture Outlet Pipe and Distributing Pipe
(Refer to Table 7.4.9.3 and Table 7.6.3.1)

Fixtures	Size of Fixture Outlet Pipe	Size of Distributing pipe
Water Closet with Flush Tank	3"	3/8"
Lavatory	1¼"	3/8"
Bathtub	1½"	½"
Domestic Sink	1½"	½"
Laundry Tray	1½"	½"

Exercise 11-8

1. Plumbing appliance

2. To prevent contaminated water from the boiler from flowing back into the potable water supply.

3. This a pressure cross-connection.

Exercise 11-9

- Pipes may break

- Other piping may become misaligned
- May cause damage to wall
- Flow of fluids into or from fixture might be impeded

Exercise 11-10

1. Temperature- and pressure-relief valves are necessary to reduce the pressure inside hot-water tanks in the event that pressure increases above normal.

2. These valves have sensing devices that are activated when the pressure inside the hot-water tank reaches a critical level.

3. A sensing device is activated when the temperature inside the hot-water tank reaches a critical level.

Exercise 11-11

1. a) Loading from a group of floor drains is expected to be handled by one trap.

   b) Gang-trapped floor drains must be in the same room and are not located where they can receive food or other organic matter—Sentence 7.4.5.1.(3).

2. Must not be installed upstream from an interceptor, because food or waste could get caught in the interceptor—Article 7.4.3.3.

3. If the floor drain is located in a room where flammable, dangerous or toxic chemicals are stored or handled—Article 7.4.3.4.

Exercise 11-12

Common deficiencies with fixtures and plumbing appliances:

- In renovated homes, you may find fixtures such as lavatories that are supported only by supply and waste pipes.
- Backflow preventers may be missing from hose bibbs.
- Cracks discovered on fixtures.
- Hot and cold water reversed.
- No vacuum breaker on a bidet.
- Fall on the fixture drains are greater than its pipe diameter.

Exercise 11-13: Testing

1. Check the proposed number of fixtures (from the plans) and the actual number of fixtures being installed.
2. Check for CSA certification on all fittings.
3. Check the sizing of supply and fixture outlet pipes from all the fixtures.
4. Are all the backflow preventers in place? i.e., hose bibb, hot-water boilers and bidets.
5. Ensure that all fixtures are supported independently of their piping.
6. Observe the smoke test if required by the CBO.
7. If everything is okay (no prior noncompliance), sign off the plumbing permit.

Exercise 11-15

Possible answer: To protect the health and safety of the municipality, e.g., in case someone in the neighbourhood has a still in his basement without a backflow preventer; this could cause some particularly nasty cross-connections.

Module 11 Quiz

1 d) Div. A 1.4.1.2.
2 c) 9.31.4.1., 9.31.4.2., and 9.31.4.4.
3 b) Div. A, 1.4.1.2.
4 d) Div. A, 1.4.1.2.
5 b) 7.2.2.1.(1)
6 c) 7.2.10.6.(1)
7 a) Table 7.4.9.3. and Table 7.6.3.1.
8 b) 7.6.2.2.
9 c) 7.3.4.2.(1)
10 c) 7.3.6.6.(1)

APPENDICES

MITEC HOUSE DRAWINGS

PLUMBING - HOUSE - 2007

Figure1:1 MITEC BASEMENT PLAN

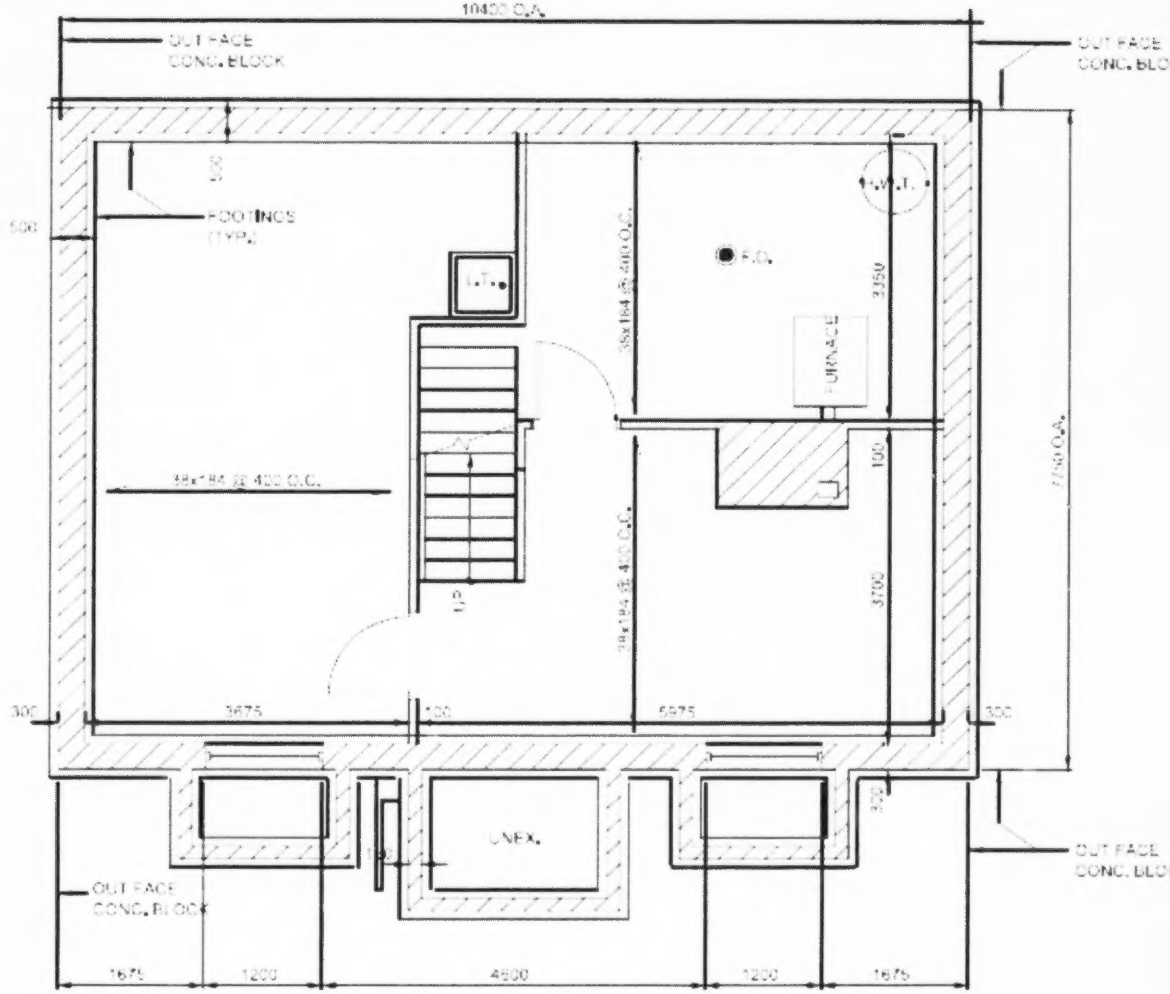


Figure1:2 MITEC FIRST FLOOR PLAN

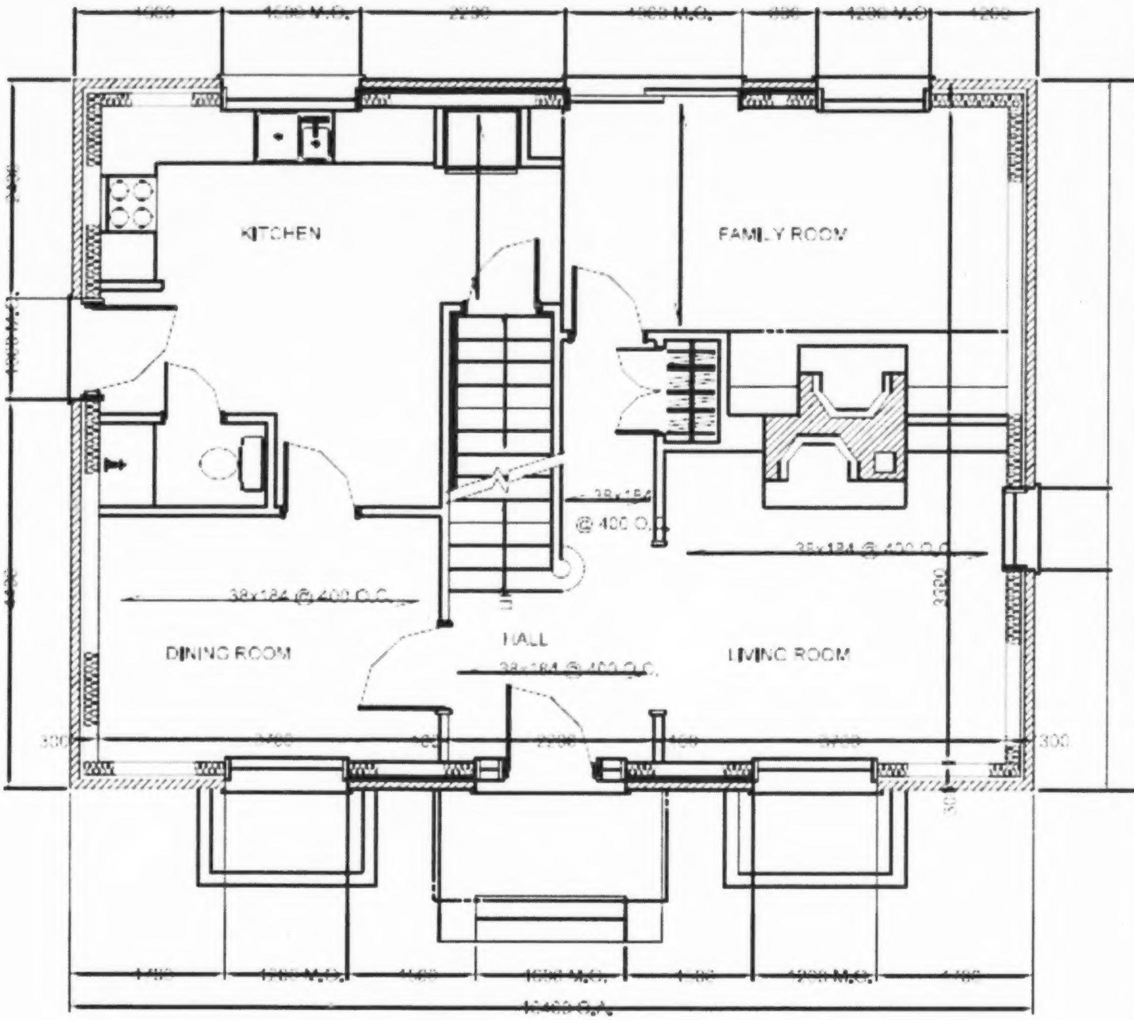


Figure1:3 MITEC SECOND FLOOR PLAN

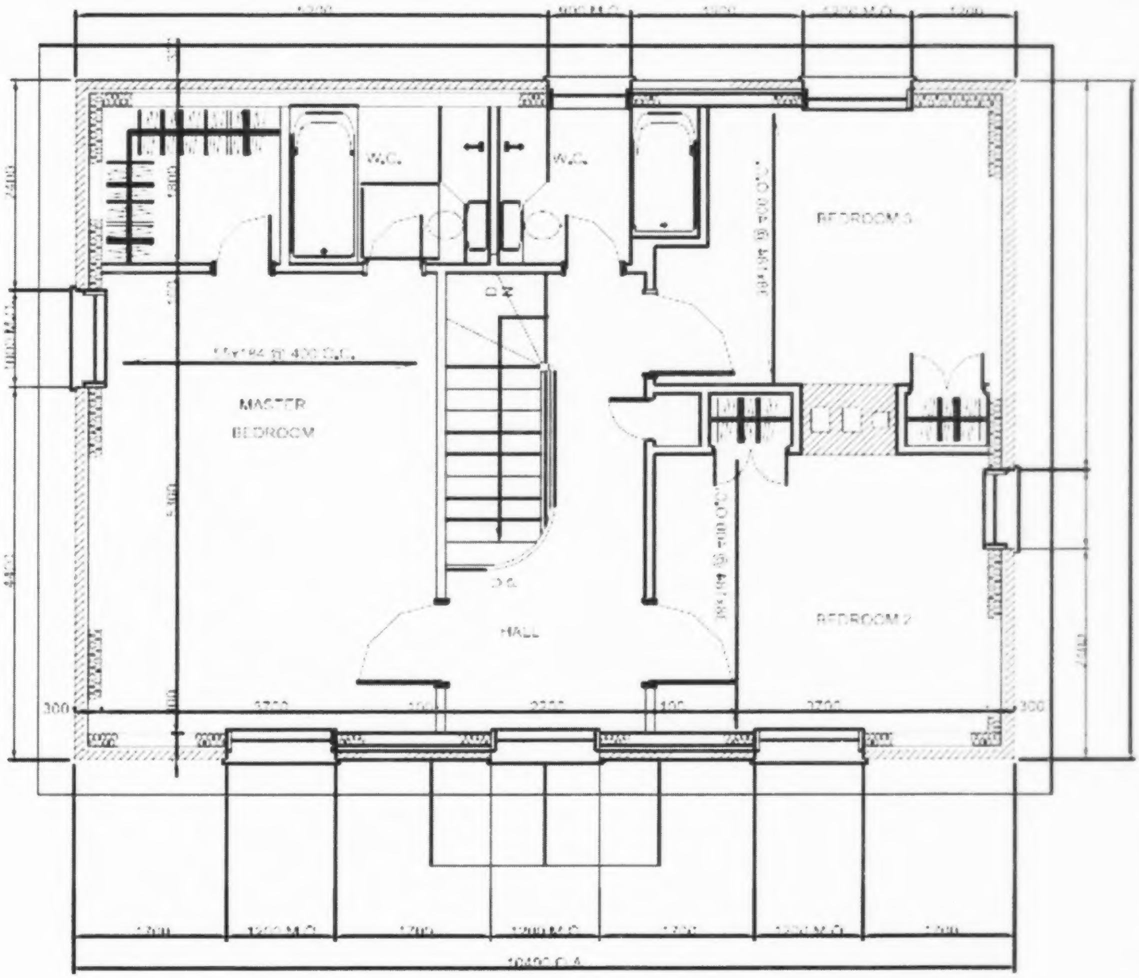
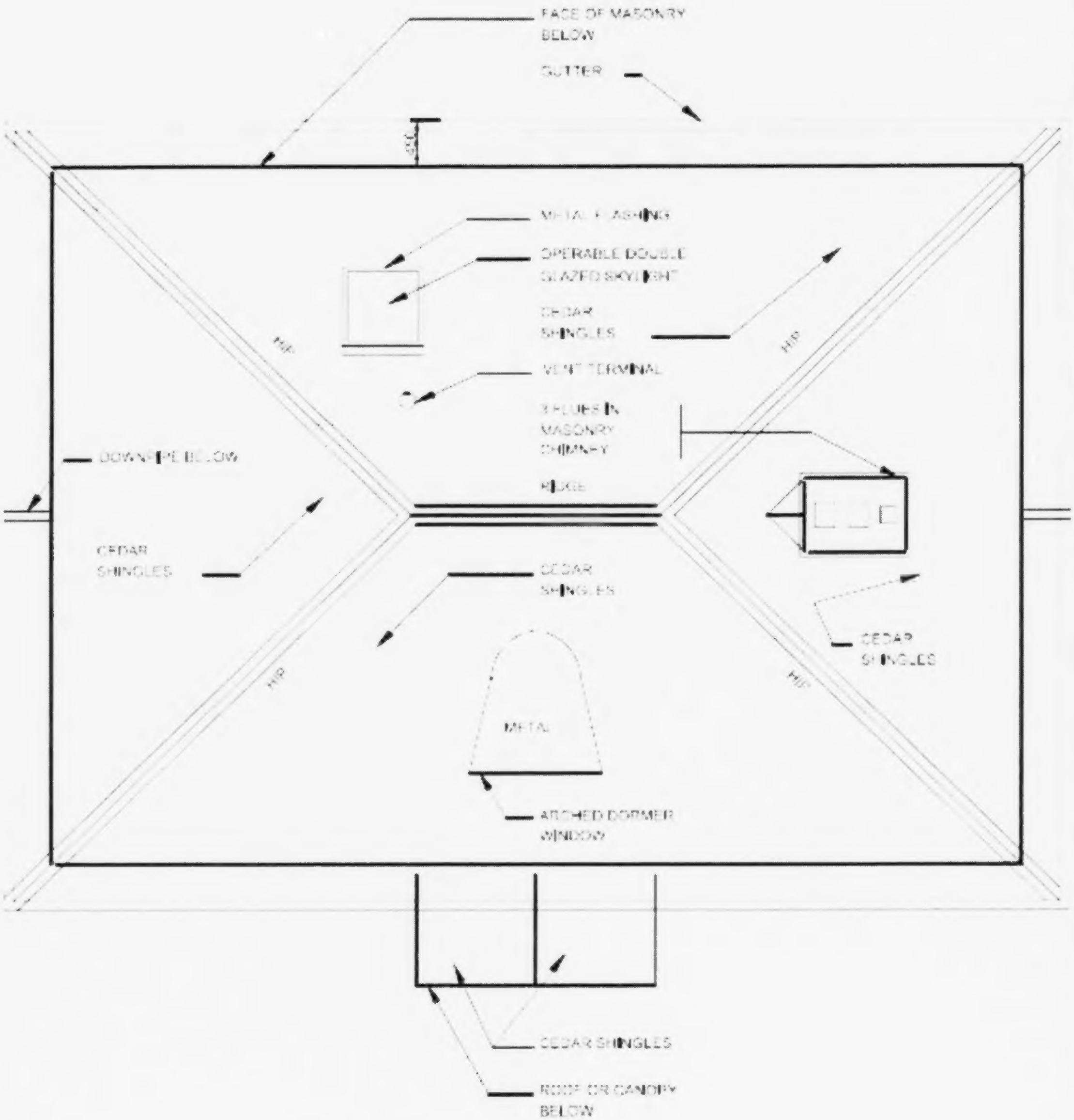


Figure1:4 MITEC ROOF PLAN



Ontario